

*Refer to parts list on page 42.

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CIRCUIT DESCRIPTION

Note: This text is concerned primarily with the TS-140. those parts that pertain to the TS-680 will be marked with an asterisk (*).

GENERAL

The TS-140 is a transceiver incorporating a general coverage receiver section utilizing double conversion principles with a first intermediate frequency (IF) of 40.005 MHz and a second IF of 455kHz.

The TS-140 covers all amateur bands from 1.9MHz to 30MHz (*1.9 thru 50MHz). It contains a 10Hz step digital PLL circuit using single crystal frequency management and microprocessor control to provide high accuracy and stability.

The major functions are as follows:

- Receiving section: General coverage from 500kHz to 30 MHz (*500kHz to 30MHz, and 50 to 54MHz)
- Covers all amateur bands from 1.9 to 30MHz (*1.9 to 54 MHz)
- Full CW break-in
- 28MHz (*50MHz) band Preamplifier control
- Manual switching of AGC time constant
- Built-in variable threshold noise blanker

- Built-in woodpecker noise blanker (NB2)
- Frequency control function with a second sub-control
- Frequency configured using a single reference oscillator
- Range specified memory

FREQUENCY CONFIGURATION

The TS-140 operates using a double conversion system for both transmit and receive (it operates using single conversion in the FM transmit mode).

Figure 1 shows the frequency configuration of the transmit and receive systems. The receiver section will be covered first.

Assume that the input frequency from the antenna is f_{IN} , the RX MIX1 local input is f_{VCO} , and the RX MIX2 local input is f_{HET} . When the incoming signal is zero beat the following relationships will hold true.

$$f_{IN} = f_{VCO} - f_{HET} - f_{CAR} \dots\dots\dots ①$$

$$\text{for VCO4, } \frac{f_{VCO4}}{J} = \frac{f_{STD}}{8K} \therefore f_{VCO4} = \frac{J}{8K} f_{STD} \dots\dots\dots ②$$

$$\text{for VCO3, } \frac{f_{VCO3}}{L} = \frac{f_{STD}}{8 \times 900} \therefore f_{VCO3} = \frac{L}{7200} f_{STD} \dots\dots\dots ③$$

$$\text{for VCO2, } \frac{f_{VCO2}}{M} = \frac{f_{STD}}{8 \times 4500} \therefore f_{VCO2} = \frac{M}{36000} f_{STD} \dots\dots\dots ④$$

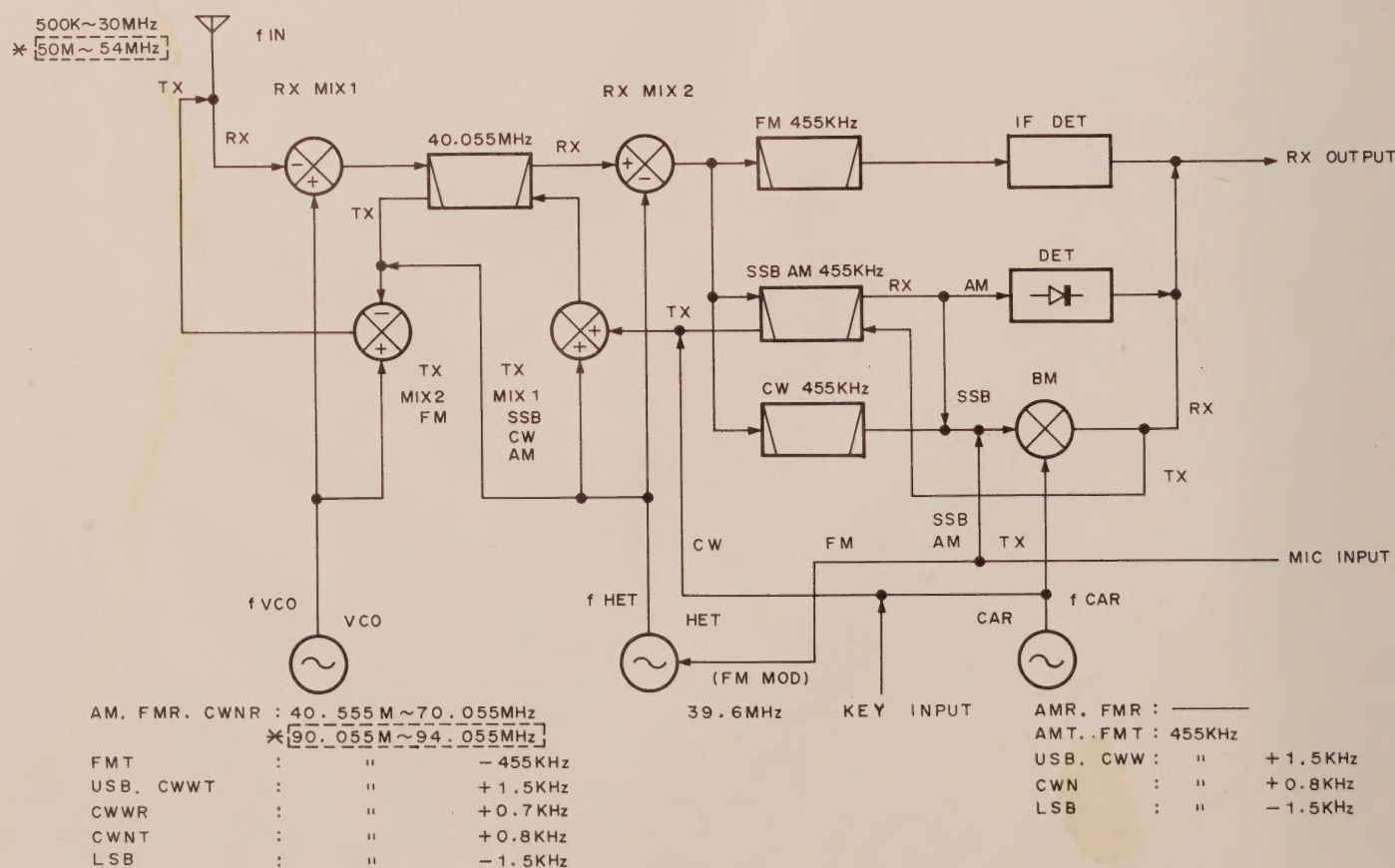


Fig. 1 Signal system frequency configuration

CIRCUIT DESCRIPTION

for VCO1, in the range of 500kHz to 30MHz

$$f_{VCO1} = \left(\frac{f_{VCO2}}{100} + \frac{f_{VCO3}}{200} + \frac{f_{STD}}{8} + f_{STD} - \frac{f_{STD}}{8} \right) = \frac{f_{STD}}{8 \times 90}$$

$$\therefore f_{VCO1} = \left(\frac{N}{720} + \frac{M}{3600000} + \frac{L}{1440000} + 1 \right) f_{STD} \dots\dots\dots (5)$$

Each local oscillator frequency may be summarized as follows:

$$f_{VCO} = f_{VCO1} \dots\dots\dots (6)$$

$$f_{HET} = f_{VCO4} \dots\dots\dots (7)$$

$$f_{CAR} = \frac{f_{VCO3}}{200} = \frac{L}{1440000} f_{STD} \dots\dots\dots (8)$$

Therefore, f_{IN} in equation (1) is expressed as follows:

VCO1-A: 500kHz to 10.5MHz:

$$f_{IN} = \left(\frac{N}{720} + \frac{M}{3600000} - \frac{J}{8K} + 1 \right) f_{STD} \dots\dots\dots (9)$$

Similarly, VCO1-B and VCO1-C are represented as follows:

VCO1-B: 10.5MHz to 21.5MHz:

$$f_{IN} = \left(\frac{N}{720} + \frac{M}{3600000} - \frac{J}{8K} + \frac{9}{8} \right) f_{STD} \dots\dots\dots (10)$$

VCO1-C: 21.5MHz to 30MHz:

$$f_{IN} = \left(\frac{M}{3600000} - \frac{N}{720} - \frac{J}{8K} + \frac{17}{8} \right) f_{STD} \dots\dots\dots (11)$$

*VCO1-D: 50MHz to 54MHz:

$$f_{IN} = \left(\frac{N}{720} + \frac{M}{3600000} - \frac{J}{8K} + \frac{17}{8} \right) f_{STD} \dots\dots\dots (12)$$

As we have shown in equations (9) to (12) above the term f_{CAR} can be eliminated, therefore the receive frequency is determined only by the reference f_{STD} and division ratios J to N (except L) (* J, K, M and N).

These equations may be further analyzed as follows:

- (1) The division ratios are determined according to the desired operating frequency, by the microprocessor, and can be assumed to essentially contain no errors.
- (2) Since each relationship is expressed using the f_{STD} linear equation, the reference frequency accuracy equals the operating frequency accuracy.
- (3) The operating frequency remains unchanged even when the value of L changes.

When $f_{IN} = 14\text{MHz}$ (USB) equation (10) is as follows:

$J = 180, K = 1,584, L = 18,260, M = 55,000, N = 251$

Therefore, $f_{IN} = 1.25 f_{STD} \dots\dots\dots (13)$

When $f_{IN} = 29.99999\text{MHz}$ (USB) equation (11) is as follows:

$J = 180, K = 1,584, L = 18,260, M = 59,999, N = 149$

Therefore, $f_{IN} = 1.82 f_{STD} \dots\dots\dots (14)$

*When $f_{IN} = 53.99999\text{MHz}$ (USB) equation (12) is as follows:

$J = 180, K = 1,584, L = 18,260, M = 59,999, N = 330$

Therefore, $f_{IN} = 2.49 f_{STD} \dots\dots\dots (15)$

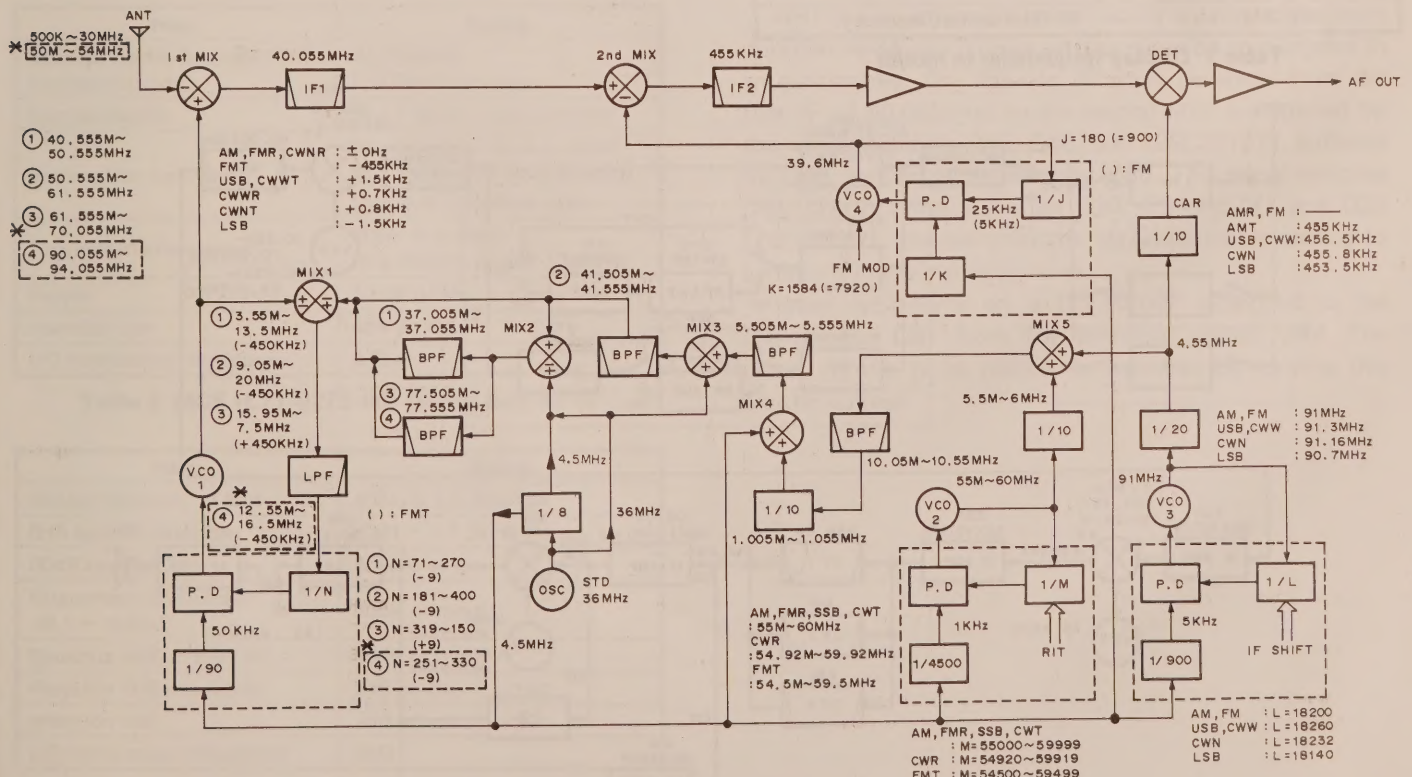


Fig. 2 PLL system frequency configuration

CIRCUIT DESCRIPTION

Since the accuracy of the reference crystal oscillator used in the TS-140 is 10PPM (-10 to $+50$ deg C), the overall accuracy is obtained by equations (9) to (12) according to characteristics (1) and (2). It is $\pm 450\text{Hz}$ for 14MHz, and $\pm 660\text{Hz}$ maximum for the frequency range of 500kHz to 30MHz. The accuracy of the transceiver is very stable.

*The total accuracy is $\pm 900\text{Hz}$ at maximum for 50 to 54 MHz.

The variable band functions such as the IF shift are controlled by the microprocessor, by controlling the value of L, thus taking advantage of the characteristics (3). The carrier point setting and initial IF shift setting are adjusted by fine tuning of fCAR.

The receive frequency in SSB mode has been discussed already. In the other modes and during transmit operations the other modes and during transmit operations frequency is determined by the reference and division ratios in the same manner as in the SSB mode in.

For CW receive the fVCO frequency is shifted down 800Hz at fVCO2.

For FM transmit the fVCO frequency is shifted down 455Hz at fVCO1 and fVCO2. The audio signal from the microphone is applied to VCO4, and fHET is directly modulated.

fCAR is stabilized by shift data During transmit and receive in the AM mode, and during receive in the FM mode.

The displayed frequency in each mode is listed in table 1.

Mode	Display frequency
USB, LSB	Carrier point frequency
CW	Transmit carrier frequency
AM, FM	IF filter center frequency

Table 1 Display frequencies in modes

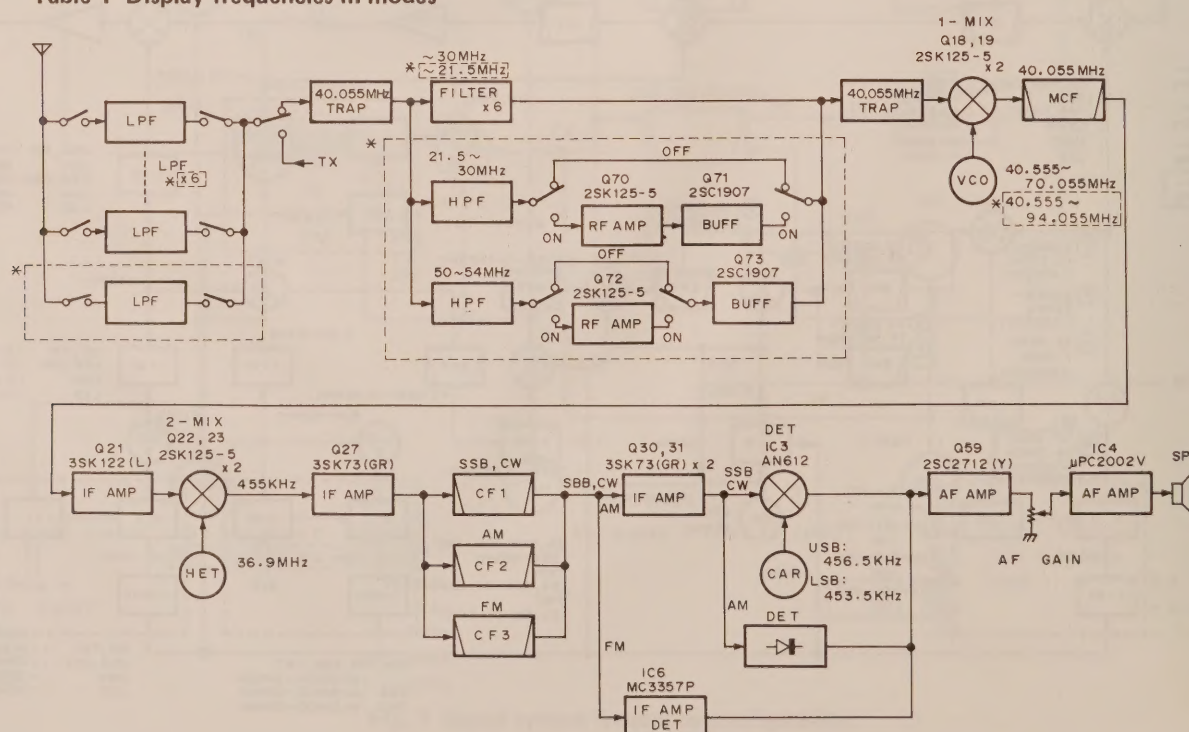


Fig. 3 Receive circuit configuration

Receive Circuit Configuration

The TS-140 receive system operates using double conversion with a first IF of 40.055MHz and a second IF of 455kHz.

The incoming signal from the ANT terminal passes through the filter unit LPF (Low Pass Filter) and transmit/receive switching relay, and is then applied to the RAT terminal of the signal unit. This signal passes through the 20dB attenuator circuit and an IF trap, and enters the 7 part HPF (High Pass Filter) (BPF for 1.6 to 2.5MHz). It combines with the LPF of the filter unit to give the required band rejection for each band.

*When the signal passes through the HPF, the preamplifier can be turned off or on via relays controlled by Q70 (2SK125-5) and Q71 (2SC1907) for 21.5 to 30 MHz or Q72 (2SK125-5) for 50 to 54MHz. When the preamplifier is turned on the signal is amplified approximately 10dB. For 50 to 54MHz the signal passes through buffer amplifier Q73 (2SC1907) for impedance matching regardless of the preamplifier state.

The signal passes through the IF trap again, and is combined with the VCO (Voltage Controlled Oscillator) in the first mixer, Q18 and Q19 (2SK125-5), to generate the first IF of 40.055MHz. The VCO circuit consists of Q9 thru Q11 (2SC2668Y), and generates 40.555 thru 70.055MHz by dividing it into three bands. The frequency is controlled by the DC signal (VCV) from the control unit.

CIRCUIT DESCRIPTION

*90.055 to 94.055MHz is generated by the VCO Q12 (2SK192A GR *J). Therefore the circuit contains four VCO's.

The first IF signal of 40.055MHz passes through the two stage MCF (Monolithic Crystal Filter) that is used in both transmit and receive, and is then amplified by the first IF amplifier Q21 (3SK122L), mixed with the 39.6MHz heterodyne signal by the second mixer, Q22 and Q23 (2SK125-5), to generate the second IF of 455kHz. The heterodyne signal is generated by the control unit, then amplified for use by Q78 (2SK73GR). One portion of the 455kHz signal is applied to the noise blanker amplifier, and the other is amplified by Q27 (2SK73GR), passed through the mode specific ceramic filter (CF1 to CF3) or an optional filter to generate the necessary bandwidth, divided into appropriate mode, and fed into each amplifier circuit.

In modes other than FM, the signal is amplified by IF amplifier Q30 and Q31 (3SK73GR), detected by IC3 (AN612) for SSB and CW, and envelope detected by D75 for the AM mode.

In the FM mode the signal is transmitted to IC6 (MC3357P) for limiting, amplification, and detection. This circuit is noise squelch controlled.

The AF signal in each mode after detection is selected by analog switch IC7 (TC4066BP), amplified by Q56 (2SC2717Y), applied to the AF volume control, and amplified the final level by IC4 (μ PC2002V).

Item	Rating
Nominal center frequency (fo)	455kHz
6dB bandwidth	± 2 kHz or less
40dB bandwidth	± 7.5 kHz or less
Insertion loss	6dB or less
Guaranteed attenuation (Within fo ± 100 Hz)	35dB or more
I/O termination impedance	2.0k Ω

**Table 4 Ceramic filter (L72-0355-05)
(Signal unit CF2)**

Item	Rating
Nominal center frequency (fo)	455kHz ± 1 kHz
6dB bandwidth (From 455kHz)	± 6 kHz or more
50dB bandwidth (From 455kHz)	± 12.5 kHz or less
Ripple (Within fo ± 4 kHz)	3dB or less
Insertion loss	6dB or less
Guaranteed attenuation (Within fo ± 100 kHz)	35dB or more
I/O termination impedance	2.0k Ω

**Table 5 Ceramic filter (L72-0315-05)
(Signal unit CF3)**

Item	Rating
Nominal center frequency (fo) and declination	40.055MHz ± 0.75 kHz or more
Pass bandwidth	fo ± 7.5 kHz or more at 3dB
Attenuation bandwidth	fo ± 25 kHz or more at 30dB fo ± 150 kHz or more at 60dB Spurious is 30dB or more
Guaranteed attenuation	60dB or more at fo ± 150 kHz \sim fo ± 1000 kHz
Ripple	1.5dB or less
Insertion loss	4dB or less
I/O termination impedance	4.2k Ω

Table 2 MCF (L71-0275-05) (Signal unit XF1)

Item	Rating
Center frequency at 6dB	455kHz ± 0.20 kHz
6dB bandwidth (total)	$\pm 1.1 \sim \pm 1.3$ kHz
60dB bandwidth	4.5kHz or less
Guaranteed attenuation (0.1 ~ 1 MHz)	60dB or more
Spurious (600 ~ 700 kHz)	40dB or more
Ripple at 6dB bandwidth	2dB or less
Insertion loss	2dB or less
I/O termination impedance	2k Ω

**Table 3 Ceramic filter (L72-0356-05)
(Signal unit CF1)**

Noise Blanker Circuit NB1

NB1 is a noise blanker circuit which is designed for short duration noise interference such as might be encountered in an automobile. The 455kHz IF signal generated from the first IF of 40.055MHz by the second MIX is amplified by the noise amplifiers Q45, Q46, Q47 (2SC2712Y), buffered by Q48, and noise detected by D86. This signal switches Q51 (2SC2712Y), turns on Q28 (2SA1162Y) and Q29 (2SC2712Y), and switches the IF signal line according to variations in the incoming noise.

When NB1 turns on, a DC voltage is applied to the emitter of Q51 from the threshold control, VR4. The effect of the noise blanker is controlled by varying this emitter voltage.

CIRCUIT DESCRIPTION

NB2

NB2 is a noise blanker circuit which blanks noises that have a relatively long duration, such as is generated by the so called "Russian Woodpecker". The noise signal is first amplified by noise amplifiers Q45 thru Q47, and then detected by D87, just as occurs with NB1. The threshold voltage on the emitter of Q50 (2SC2712Y) is also controlled by VR4. Q50's output enters the NB2 module unit X59-3350-00 to synchronize pulse width and period signals with the woodpecker noise.

1/4, 4/4 and 2/4, 3/4 of IC1 (TC4011BF), are adjusted to a pulse width of 40ms.

Normally, woodpecker type noise has a pulse width of 3 to 4ms and a period of 80 to 100ms, but some woodpecker noise signals might have a period of approximately 50ms, although rare.

Therefore, even woodpecker noise with a large pulse width can be blanked by switching the noise at a 5ms rate. However, if noise with a period of several ms is encountered, such as ignition noise, and is blanked at this same interval, then the signal level will drop or become zero. To prevent this from occurring a one-shot multivibrator, composed of IC1 2/4,3/4, is utilized so that the next pulse does not occur until after a delay of 40ms, from the last output from IC1 1/4,4/4.

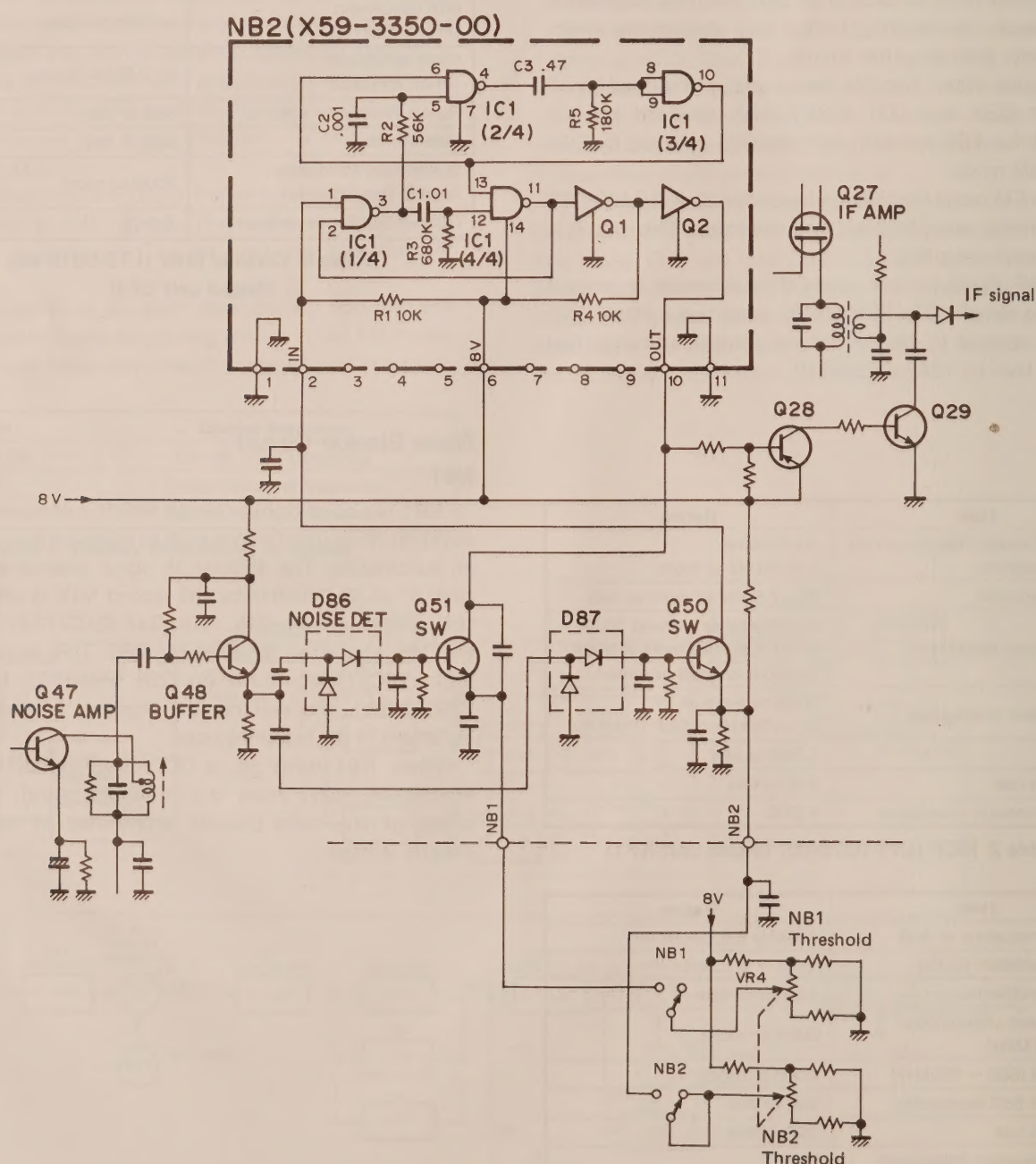


Fig. 4 Noise blanker circuit

CIRCUIT DESCRIPTION

Transmit Circuit Configuration

The transmit system operates utilizing double conversion for SSB, CW and AM and single conversion when operating in the FM mode.

The audio signal from the microphone terminal enters from the switch unit (CN5 "MIC"), and divides into a modulation and a VOX signal. The modulation signal is amplified by approximately 20dB by IC1. Signals from data communications devices enter the ACC2 terminal on the rear panel of the radio and are applied to IC1. The output from IC1 is applied directly to the MIC GAIN control on the front panel and to the FM modulation circuit.

The VOX signal is amplified by Q6 and enters the signal unit (CN501 "VOX"), and then enters the VOX module (X59-1080-00). The output from this module passes through the VOX switch and enters the DELAY TIME module (X59-3360-00) to control the transmitter and receiver.

During SSB and AM operation the signal that passes through the microphone gain control will enter the signal unit (CN1 "MV2"), where it is amplified by Q74 (2SC2712 Y) and applied to the balanced modulator IC3 (AN612). In the AM mode, however, the balance of IC3 is upset to generate the AM signal. Q74 does not operate in FM and

CW modes because the voltage is applied to the emitter thru diode D89. The 455kHz DSB (Double Side Band) signal generated by IC3 passes through the transmit switching diodes D55 and D64, filter switching diodes D56, D57 (SSB), or D57, D60 (AM) to generate the 455kHz SSB or AM signal.

The SSB and AM signals pass through transmit switching diode D55, and are amplified by IF amplifier Q86. The carrier in CW mode optimizes the level past the PIN diode D74. The signal then passes through switching diodes D109, D110, and D122 and enters Q86 (3SK73GR).

Q86 is used to perform ALC (Automatic Level Control) and CW keying.

The 39.6MHz HET signal from the control unit enters the signal unit (CN21 "HET") and is amplified by HET amplifier Q78 (3SK73GR). This HET signal passes through switching diode D100, in the SSB, CW and AM modes, and is fed into the first transmit mixer IC5.

The output from the IF amplifier also enters IC5 and is combined with the HET signal to generate a 40.055MHz signal.

The output from IC5 passes through a MCF, which removes spurious components and enters the second transmit mixer Q79 and Q80 (3SK122L).

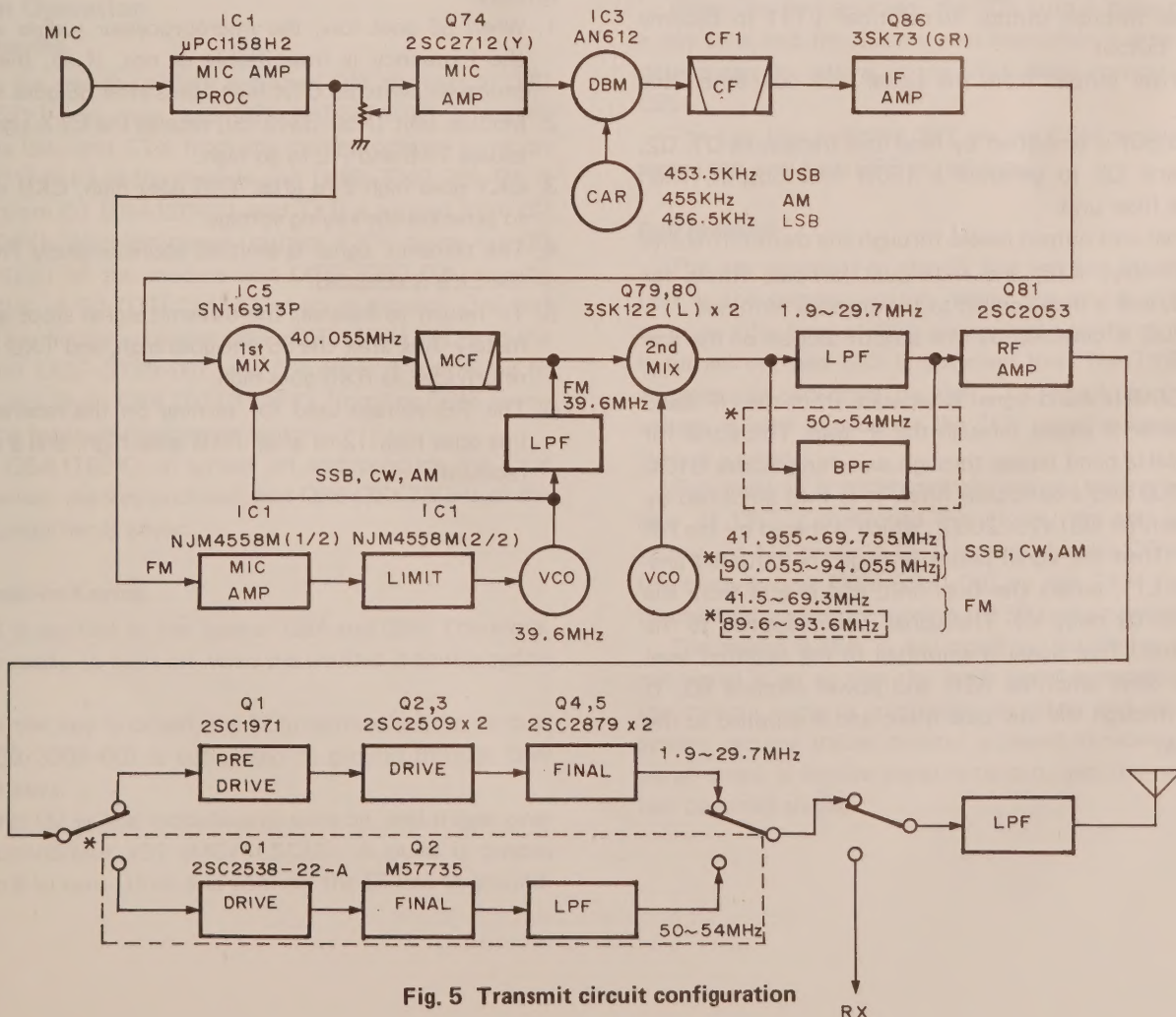


Fig. 5 Transmit circuit configuration

CIRCUIT DESCRIPTION

In FM the output of the MIC amplifier, IC1 of the switch unit, enters the signal unit FM MIC amplifier module (X59-3000-02). This module also functions as the MIC amplifier, limiter circuit, and low-pass filter circuit. The output enters the control unit from the FMM terminal and modulates the 39.6MHz oscillator, VCO4. In modes other than FM, the power of the FM microphone amplifier module is not turned on, and therefore modulation is not affected.

The 39.6MHz signal from the control unit to the signal unit is the HET signal for SSB, AM, and CW modes and the first IF frequency in the FM mode. The IF frequency which enters the signal unit is amplified by IF amplifier Q78. Q78 is the ALC controller. The second gate of Q78 has a fixed bias in modes other than FM, therefore ALC does not function.

The output from Q78 (3SK73GR) passes through switching diodes D101, D102, and D124, a low-pass filter, and is delivered to the final mixer (the second mixer in modes other than FM). Since the IF frequency in the FM mode is different from that in the other modes, the frequency is corrected by the final VCO.

The signal is converted into an actual transmit frequency by the final mixer and passes through the IF trap (40.055 MHz) and low pass filter, is amplified by RF amplifier Q81, and passes through output transformer L111 to become the driver output.

The driver output from the signal unit now enters the final unit.

The output is amplified by final unit transistors Q1, Q2, Q3, Q4 and Q5 to generate a 100W final output. Then enters the filter unit.

The final unit output passes through the transmit/receive switching relay, K16, and individual low-pass filters for each band, and is then applied to the antenna terminal.

The ALC is detected by the output section of the low pass filter.

*The 50MHz band signal is separate from the HF band signal after it passes through the IF trap. This signal for the 50MHz band passes through switching diodes D104, and D106 and a band-pass filter. It is then amplified by RF amplifier Q81 (2SC2053), which is shared by the HF bands. Then the signal passes through the output transformer L11, enters the final unit, and is split from the HF path by relay K1. The signal is then applied to the filter unit. This signal is amplified to the required level by the drive amplifier (Q1) and power module Q2. It passes through the low pass filter, and is supplied to the antenna.

Standby Control Circuit

To switch between transmit and receive for full break-in, or for AMTOR/Packet use, the microprocessor sends various timing signals to control the transmit/receive circuits.

When the standby signal SS from the Standby switch is applied to the microprocessor, three signals are generated, CTX, RB, and CKY. Signals TXB, RXB, and RL are generated based upon these signals to operate the transmit/receive circuit.

The role of each of these signals is describe below:

SS: Reference signal to control each signal (standby switch, PTT switch, and key input)

CTX: Control signal from the microprocessor to generate TXB

RB: Control signal to mute the receive signal line

CKY: Control signal for keying

TXB: 8V line for the transmit circuits

RXB: 8V line for the receive circuits

RL: 13.8V line for the transmit circuits

CKB: 8V line for keying generated by CKY

The signal timings are shown in the figure 6.

The timing after the standby switch is switched to transmit and until the system return to the receive state is as follows:

1. When SS goes low, the microprocessor judges whether the frequency is transmittable or not. If so, the microprocessor switches CTX high 10ms after SS goes low.
2. Module unit (X59-3340-00) receive the CTX signal, and causes TXB and RL to go high.
3. CKY goes high 2ms after TXB goes high, CKB is driven to generate the keying voltage.
4. The transmit signal is emitted approximately 7ms after the CKB is actuated.
5. To return to receive, the transmit signal stops approximately 7ms after the SS line goes high, and TXB and RL return low, as RXB goes high.
6. The RB voltage used for turning on the receive signal line goes high 12ms after RXB goes high, and a signal is received.

CIRCUIT DESCRIPTION

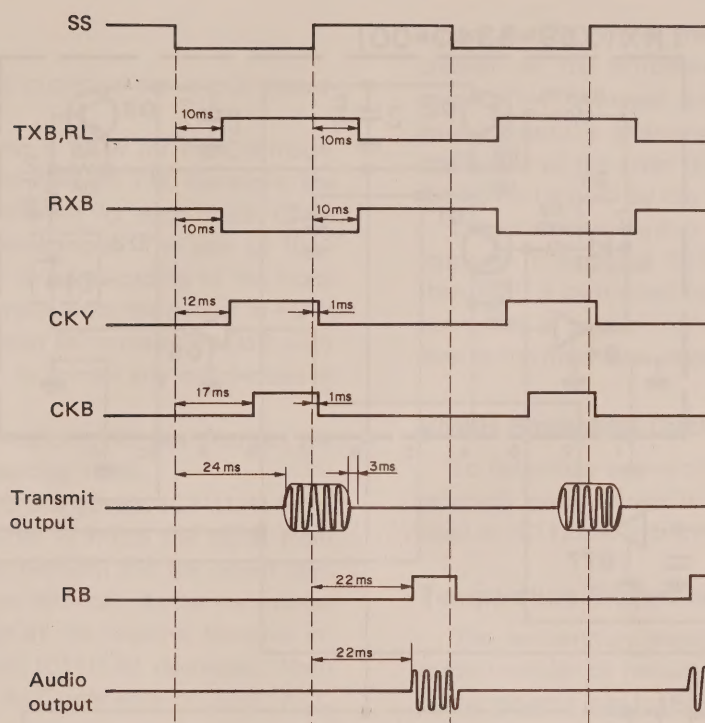


Fig. 6 Transmit/Receive timing chart

Break-in Operation

Manual keying

When the standby switch is turned ON, the base of Q90 (2SA1162Y) goes low, and Q91 (DTC114EK) turns on. CSS goes low, and CTX from the microprocessor turns on Q4 (DTC114EK) of the module unit (X59-3340-00). RL is emitted from Q1 (2SA1204Y), and TXB is applied from Q2 (2SA1204Y). Microprocessor output CKY turns on Q5 (DTC114EK) of the module unit (X59-3360-00), causing the emitter of Q7 (DTC114TK) to go to ground. One end of the Q7 collector is connected to Q87 (2SA1162Y) of the signal unit (X57-3190-00), and the other is connected to the key jack from Q84 (DTC114EK) from the COM terminal via the break-in changeover switch.

Q87 (2SA1162Y) is turned on and produce the CKB voltage when the key is closed, and Q86 (3SK73GR) of the send IF amplifier is keyed.

Semi-Break-In Keying

CW8 is applied to the base of Q84 and Q99. Therefore, they are ready to turn on when the emitter is connected to ground.

When the key is closed, the SEM terminal of the module unit (X59-3360-00) is connected to ground through Q99 and Q84 keys.

Q6 and Q2 in the module unit turn on, and trigger one-shot multivibrator IC1 (MB74LS122). A pulse is output from pin 8 to turn Q1 on and connect the SS line to ground.

When the key is closed, the IC8 output pulse returns to a low level and the SS line goes high after a time constant determined by setting of the VOX delay control VR7 and C254.

The key line switches Q87 via the COM terminal at this same time, and keys Q86 in real time.

Full Break-In

The key connects to the SS line and has the same function as the standby switch. When the key is closed, Q84 turns on, the base of Q90 is connected to the ground, Q91 is turned on, and CSS is switched low. The TXB and RL voltages are generated by the CTX signal, and the CKB voltage is used to generate the CKY signal voltage just as in manual keying.

Full break-in is different from manual keying in that the base of Q87 is controlled directly by the key in manual keying. In full break-in Q87 is controlled via Q5 and Q7 of the module unit (X59-3360-00) by the CKY signal from the microprocessor by turning the SS line on and off.

The reason is that in full break-in, the timing the transmit signal is set so that the radio signal is transmitted after the control signal is completely switched and the transmit system become stable; control is passed to receive after the signal stops, a receive signal is output, and the receive system becomes stable.

CIRCUIT DESCRIPTION

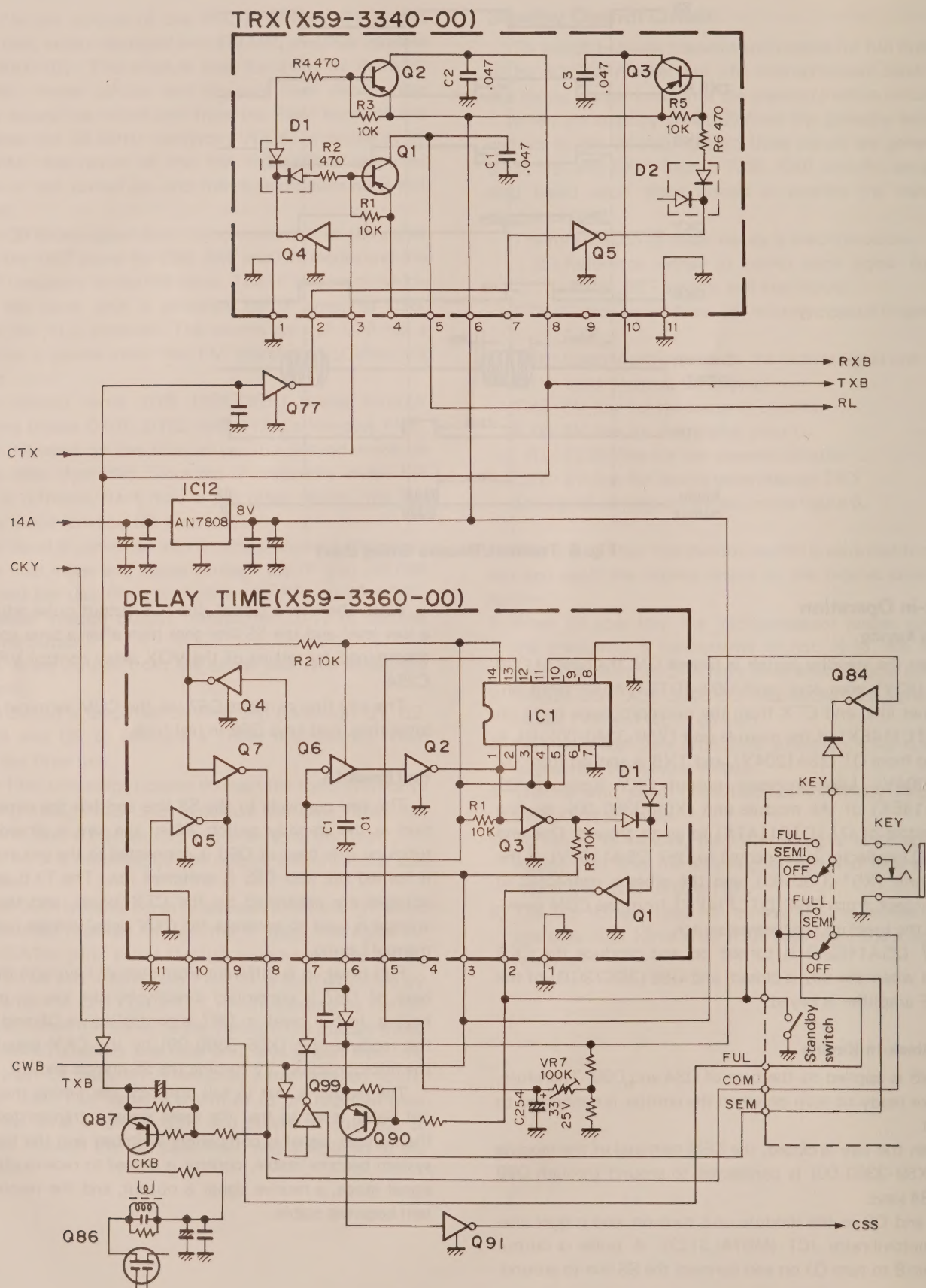


Fig. 7 Standby control circuit

CIRCUIT DESCRIPTION

ALC Circuit

A new ALC circuit is used to control the output according to the selected mode.

The output in the HF band is 100W for the CW mode, 110W for the SSB mode, and 50W for FM. therefore, the ALC detection voltage is different for each mode. CW is used as the standard reference mode. The gain of IC11(3/4), in the ALC circuit, is varied according to the mode and transmit power. For example, since the output in FM is 50W the gain of IC11(3/4) must be increased by 3dB, with respect to the CW reference, to correct any deficiencies in the feedback voltage.

*Since the 50MHz band has only 10 watts output the gain of IC11(3/4) is increased by 10dB.

IC11(1/4) controls the ALC and power. IC11(1/4) functions as a differential amplifier in which the signal from IC11(3/4) enters the negative terminal and the power control voltage enters the positive terminal. As the transmitter output increases, the voltage at the negative terminal increases, and the output from IC11(1/4) decreases. When this output falls below the ALC reference of 2.5V, ALC action will begin.

The power is controlled by changing the voltage at the positive terminal of IC11(1/4). For the AM and CW modes the power is fixed at its maximum full power state since the center of VR2 (PC2) is held open.

The power control voltage (PCV) changes with power, voltage and temperature. When the power, or voltage rises, the PCV is limited by zener diode D116 to avoid excessive

power output. When the voltage falls, the power is increased. As the temperature rises, the resistance of thermistor TH4 decreases, and the PCV rises, but excessive power output is prevented by the (negative) temperature coefficient of the zener diode. When the temperature falls, the PCV is reduced by the thermistor, and power is reduced.

The drive level is also controlled in the FM mode. The input to IF amplifier Q78 (HET amplifier in modes other than FM) is controlled by PIN diode D96. The capacitor connected in parallel is provided to gain the minimum drive level at the maximum power.

VSWR Protection Circuit

To determine a time constant for the reflected wave, the reflected wave voltage is amplified by IC11(2/4) and applied to IC11(3/4) to provide protection.

Temperature Protection Circuit

The temperature detection circuit of the final unit is made modular to reduce its size. The surface temperature of the radiator is as follows:

Cooling fan start 50 deg C

Cooling fan stop.....45 deg C

Temperature protection start.....80 deg C

Temperature protection stop 70 deg C

When the temperature protection operates the ALC voltage and the power fall. The system does not return to the receive state.

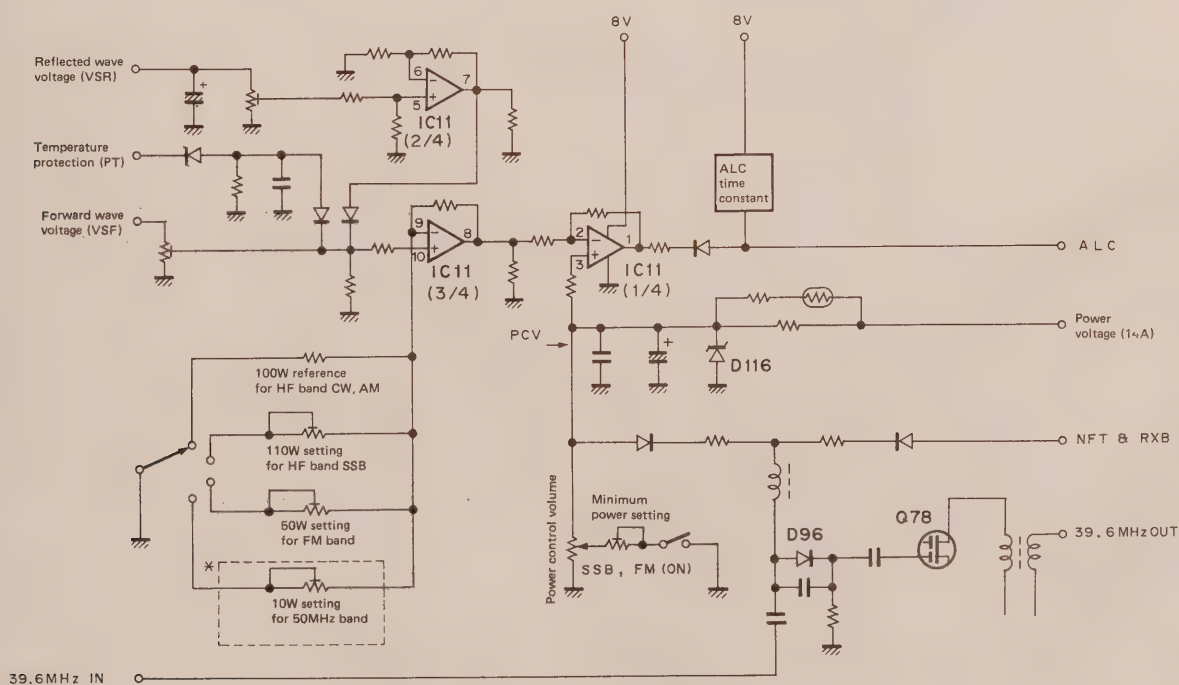


Fig. 8 ALC and power control circuit

CIRCUIT DESCRIPTION

Speech Processor Circuit

The SWITCH UNIT (A/4) IC1 is an audio type speech processor which also function as the first stage microphone amplifier. When the processor switch is OFF, the switch unit operates as a 20dB microphone amplifier. When the processor switch is ON, it operates as an ALC controlled amplifier with ALC with a maximum gain of 40dB.

The compression is set to approximately 20dB when the input signal to the MIC terminal is 10mV.

When the processor switch is ON, 8V DC is applied to the base of the gain adjustment switching transistor Q1. Simultaneously the feedback amplifier begins operating.

When the switch unit is put on stand-by remotely by data from terminal units connected to accessory terminal number 2 (such as packet, and AMTOR) Q2, Q3, and Q4 are turned ON, the microphone circuit is muted, the SS terminal is switched low, thus stabilizing the transmission.

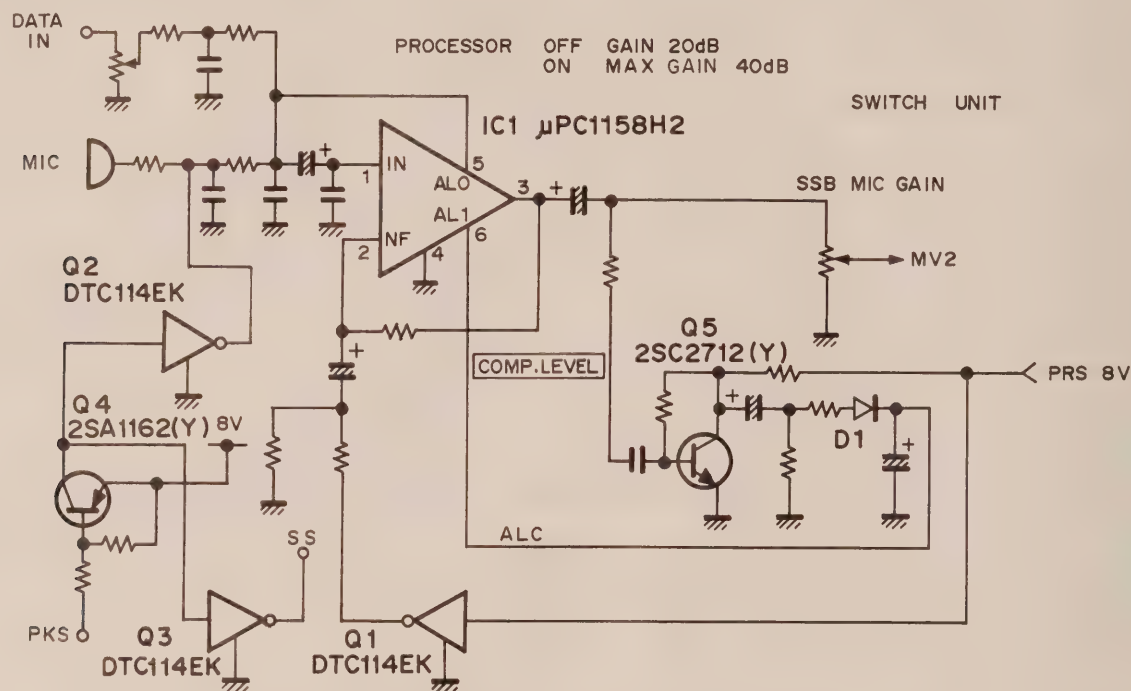


Fig. 9 Speech processor circuit

PLL Circuit

The TS-140 PLL circuit consists of three PLL loops which cover 500kHz to 30MHz in 10Hz steps with a reference frequency of 36MHz.

*The PLL circuit consists of four PLL loops, including 50MHz to 54MHz.

The carrier frequency is inserted into the PLL loop to provide the IF shift function. The carrier circuit PLL loop and the HET circuit PLL loop that always generates a 39.6 MHz frequency are also included. Division ratio data to these PLL loops controlled by the microprocessor. A single crystal frequency management method, in which phases are compared with that of a reference frequency f_{STD} , is used for this transceiver.

The block diagram of the PLL circuit is provided in figure 10.

The reference frequency f_{STD}, which is used as a basis for TS-140 frequency control, is generated by a 36MHz crystal and oscillator Q9 (2SC2787L). The f_{STD} passes through buffers Q10 and Q12 (2SC2668Y), enters IC10 (SN16913P), passes through a LPF, and enters IC11 (SN16913P). This signal passes through buffer Q11 (2SC2668Y), and is divided by 8 in IC8 (M74LS93P) to generate a 4.5MHz signal. This signal passes through a LPF, and enters IC9 and IC11 (SN16913P) in the main loop. The signal passes through a LPF, and become the 4.5MHz reference frequency, f_R, for each PLL circuit.

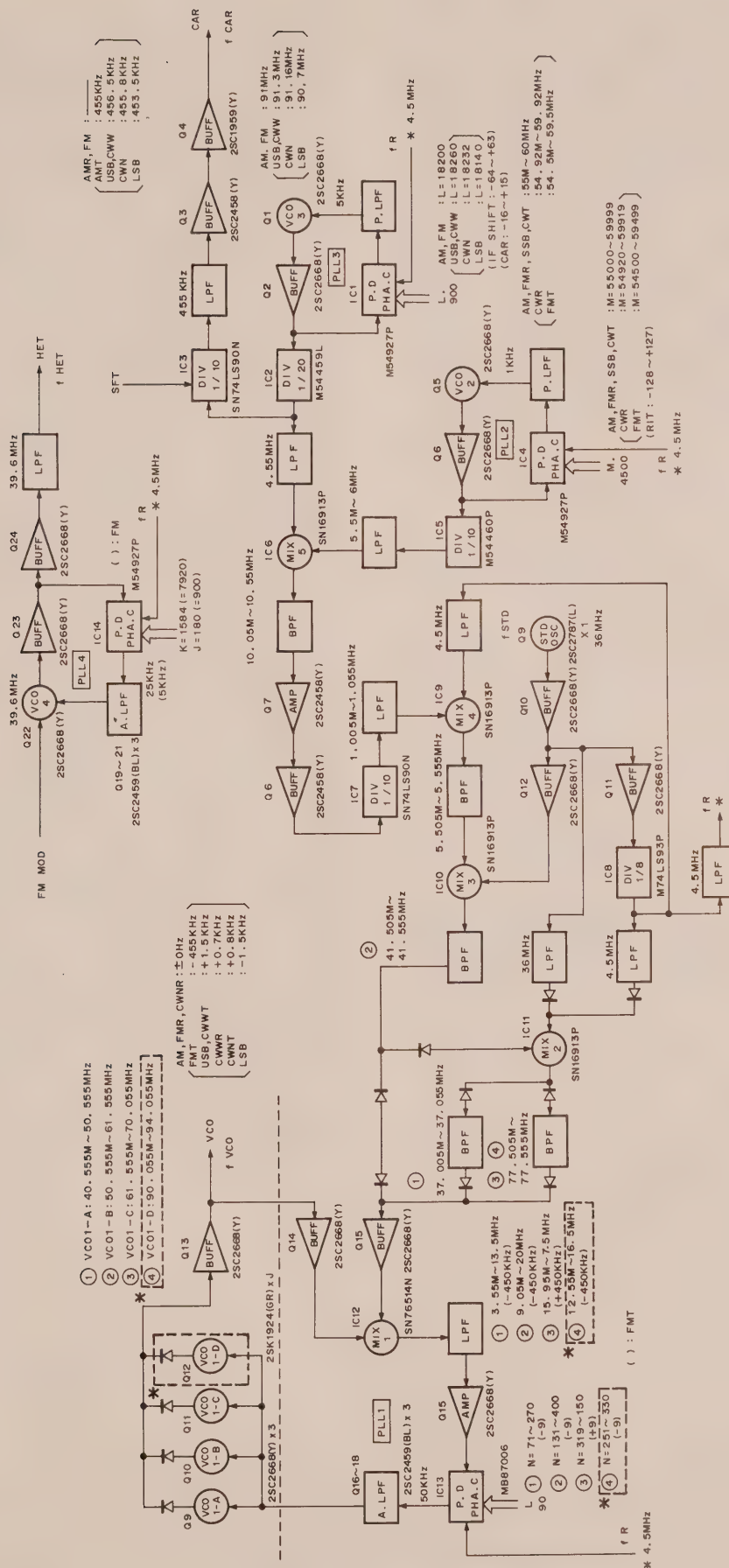


Fig. 10 PLL block diagram

CIRCUIT DESCRIPTION

PLL4

PLL4 consists of IC14 (M54927P), and VCO4, Q22 (2SC2668Y), is locked at 39.6MHz. The 4.5MHz reference frequency, f_R , is applied to IC14 pin 15, and is divided internally by 180 (900 for FM) to generate a comparison frequency of 25kHz (5kHz for FM). The from VCO4 output passes through buffer Q23 (2SC2668Y), applied to IC14 pin 3, and divided internally by 1584 (7920 for FM). The resulting signal is compared with the 25kHz (5kHz for FM) reference signal by the phase comparator, thus locking VCO4. Division ratios K and J are transmitted from digital control circuit via DA, CK, and PR4.

The output from PLL4 passes through Q24 (2SC2668Y) and a LPF and is fed into the signal unit as the HET signal.

PLL3

PLL3 consists of IC1 (M54927P), and VCO3, Q1 (2SC2668Y), is locked at about 91MHz with a frequency that varies with the mode.

The 4.5MHz reference frequency, f_R , is applied to IC1 pin 15, and divided internally by 900 to generate a 5kHz comparison frequency. The output from VCO3 passes through buffer Q2 (2SC2668Y), is applied to IC1 pin 3, and multiplied internally by the division ratio (about 1/18200) determined according to the mode. The resulting signal is compared with the 5kHz reference signal by the phase comparator, thus locking VCO3. Division ratio L is transmitted from the digital control circuit via DA, CK, and PR3.

The PLL3 output is divided by 20 in IC2 (M54459L), and directed to two circuits. One signal enters IC3 (SN74LS90N) of the carrier circuit, is divided by 10, passes through a LPF, buffers, Q3 (2SC2458Y) and Q4 (2SC1959Y) and fed into the signal unit as a carrier signal. During AM reception and AM/FM transmission, IC3 operation is stopped by the SFT data signal to remove the carrier signal.

The other signal is divided by 20, passes through a LPF, and enters MIX5 IC6 (SN16913P) in the main loop, which is part of the digital VFO. Therefore, the operating frequency remains unchanged even if the carrier frequency is changed to implement features, such as USB/LSB mode switching, IF shift, and fine adjustment of the carrier point. IF shift allows a shift of ± 1 kHz or more during SSB and CW receive. The carrier point can be finely adjusted, in the SSB mode, thru a range of -400 Hz to $+375$ Hz.

PLL2

PLL2 consists of IC4 (M54927P), and VCO2, Q5 (2SC2668Y), is locked thru a range of 55MHz to 59.999MHz, except in CW receive and FM transmit. The 4.5MHz reference frequency, f_R , is applied to IC4 pin 15, and divided internally by 4500 to generate a 1kHz comparison frequency. The from VCO2 output passes through buffer Q6 (2SC2668Y), is applied to IC4 pin 3, and divided internally by M. The resulting signal is compared with the 1kHz reference signal, by the phase comparator, thus locking VCO2. Division ratio, M, is transmitted from the digital control circuit as division data in 4,999 steps (55,000 to 59,999) corresponding to the range of 0.00kHz to 49.99kHz or 50.00kHz to 99.99kHz via DA, CK,, and PR2.

Correction is performed according to the mode and RIT operation. To obtain the 800Hz beat tone obtained during CW reception, M is shifted (54,920 to 59,919) by about 80. Since the VCO1 output frequency during FM transmit is 455kHz lower than that during receive, it is corrected 5kHz (54,500 to 59,499) by VCO2. (450kHz is corrected by PLL1.) When the RIT is operating, the M division ratio is varied so that the from VCO1 output frequency is shifted ± 1.2 kHz or more.

In AM and FM modes, the frequency is shifted 10 steps, and operates in 100Hz steps as shown in the frequency display.

The PLL2 output is divided by 10 in IC5 (M54460L), passes through a LPF, and is applied to pin 2 of MIX5 IC6 (SN16913P). The signal is mixed with the signal generated by PLL3, passes through a BPF, and become a signal of 10.05MHz to 10.5499MHz, in 100Hz steps. The signal passes through amplifier Q7 (2SC2458Y), buffer Q8 (2SC2458Y), is divided by 10 in IC7 (SN74LS90N), passes thru a LPF, and is applied to pin 2 of MIX5 IC9 (SN16913P). The signal is mixed with the 4.5MHz signal generated by dividing the reference frequency by 8 in MIX4 (SN16913P), passes through a BPF, become a signal of 5.505MHz to 5.55499MHz in 10Hz steps, and is applied to pin 2 of MIX3 IC10 (SN16913P). In addition, the signal is mixed with the 36MHz reference frequency by MIX3, passes through a BPF, and become a signal of 41.505MHz to 41.50499MHz.

CIRCUIT DESCRIPTION

PLL1

The final PLL1 loop consists primarily of IC13 (MB 87006). The final VCO1 is located in the signal unit, and consists of three VCOs, VCO1A to VCO1C, that cover a dial frequency of 500kHz to 30MHz. (*The final VCO1 consists of four VCOs, VCO1A to VCO1D, in the range of 50MHz to 54MHz.) Any of the VCOs can be selected according to band information from the digital control circuit. The VCO1 signal passes through buffer Q13 (2SC2688Y) of the signal unit, and is applied to the PLL circuit of the control unit. This signal passes through buffer Q14 (2SC2668Y), and is applied to pin 5 of MIX1 IC12 (SN76514N). The signal is mixed with the signals generated by PLL3 and PLL2. This input signal is also divided into three signals according to band information.

One of the signals generated in the previous loop is applied directly to buffer Q13 (2SC2668Y) by the diode switch according to the band information. The other signal is applied to pin 2 of MIX2 IC11 (SN16913P). When the operating frequency is 500kHz to 10.5MHz, the signal is mixed with the 4.5MHz signal generated by dividing the reference signal by 8 in MIX2, passes through a BPF, become a signal of 37.005MHz to 37.05499MHz, and is applied to buffer Q13. When the operating frequency is 10.5 MHz to 21.5 MHz, the signal is applied directly to buffer Q13 without passing through MIX2. When the operating frequency is 21.5MHz to 30MHz, the signal is mixed with the reference frequency in MIX2, passes through a BPF, becomes a signal of 77.505MHz to 77.55499MHz, and is applied to buffer Q13.

*When the operating frequency is 50MHz to 54MHz, the signal is processed in the same way as the signal for 21.5MHz to 30MHz.

These signals are applied to pin 11 of MIX1 IC12 through buffer Q13. The difference signal passes through a LPF to become a signal of 3.55MHz to 20MHz, passes through amplifier Q15 (2SC2668Y), and is applied to pin 8 of PLL IC13.

The 4.5MHz reference frequency, f_R , is applied to IC13 pin 1, and divided internally by 90 to generate a 50kHz comparison frequency. The signal input to IC13 is divided by N, and compared with the 50kHz reference signal, by the phase comparator. The signal passes through an active LPF, Q16 to Q18 (2SC2459BL), and is sent to the signal unit as the VCO voltage, to control the varactor diode of the last VCO1.

Division ratio, N, covers the overall operating frequency range in 50kHz steps, except during FM transmit. During FM transmit, N is shifted 9 steps (450kHz) so that the VCO1 output frequency becomes -455kHz. The division ratio is sent from the digital control circuit via DA, CK, and PR1.

Therefore, the final output of PLL1 is 40.555MHz to 70.05499MHz (shifted by -455kHz for FM transmission) as determined by the values of L, M, and N, in 10Hz steps.

*The final output of PLL is 40.555MHz to 70.05499 MHz or 90.055MHz to 94.05499MHz in 10Hz steps.

UNLOCK Detection

If any PLL loop becomes unlocked, pin 11 of IC1, IC4, IC14 and/or pin 7 of IC13 go low, and act as an OR circuit. These signals pass through switching transistors Q25 (DTA124ES) and Q26 (DTA124ES), and the "L" is sent to the digital control circuit.

At this point, the microprocessor will display the unlock status, and emits the SBK signal to stop the IF signal before the filter via Q29 (2SC2712Y), and the MUTE signal for stopping the audio signal via Q57 (2SC2712Y) before entering the volume control.

50kHz Marker Signal

IC13's 50kHz comparison frequency is emitted from pin 13 and used as a marker signal.

CIRCUIT DESCRIPTION

Digital Control Circuit

Configuration of microprocessor peripheral circuits

As shown in figure 11, the units around microprocessor IC18 (BU18400A) include 16K ROM, IC21 (MBM27C128-25JAJ2), 2K static RAM, IC20 (TC5518CPL), extended I/O IC (TMP8255AP-5; IC22 and IC23 for output only, and IC24 for input only), encoder processing gate array IC26 (LZ92K37), and the microprocessor optional IF-IOC communication IC (μ PD8251AFC). The microprocessor address signal is selected by transmitting the chip select signal from IC19 (SN74LS138N). IC15 (PST520D) generates a reset signal according to changes in the 5V line, to reset the microprocessor, the extended I/O IC, and communications IC. The reset signal is also sent to RAM to prevent data destruction due to shock noise when switching power on and

off. IC16 (TC4069UBP) rectifies the waveform of the reset signal, and also functions as the buzzer oscillator circuit and system clock oscillator circuit. The timer IC, IC17 (NE555C), generates an AC signal for dynamic lighting of the fluorescent display tube, and gives an interrupt signal to the microprocessor. The dynamic lighting function is controlled by the microprocessor. The μ PC6300C is the fluorescent display tube driver IC. IC27 (MB4052) is an A/D converter IC to which a voltage corresponding to the rotational position is applied by a variable resistor such as the RIT. IC25 (TC4069UBP) operates as a chatter absorption circuit for the mechanical-type sub-dial rotary encoder.

Most of these circuit are located in the control unit, but the fluorescent display tube, drive IC (μ PD6300C), and voltage generation DC/DC module (CPS1175B) are in the display unit.

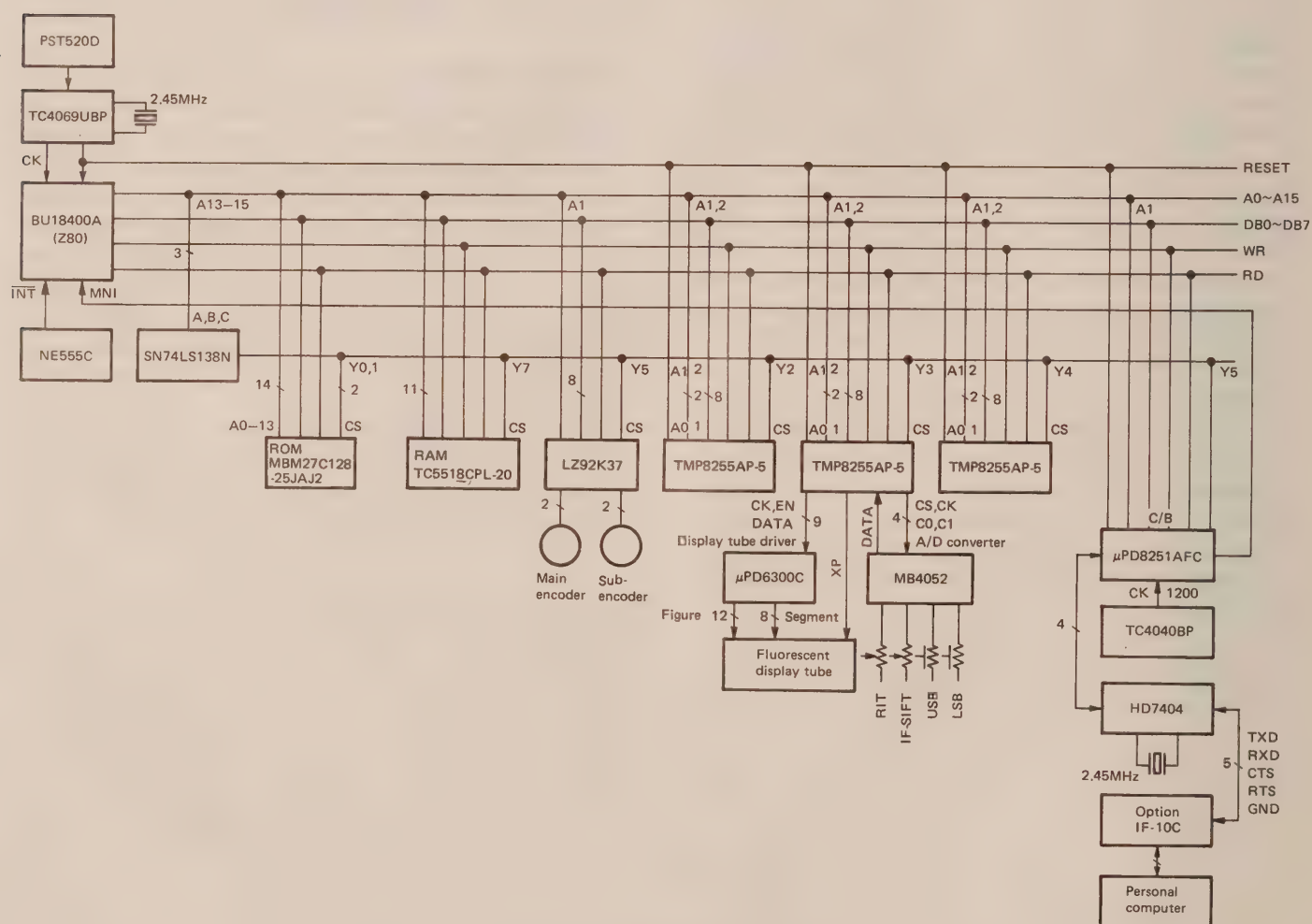


Fig. 11 CPU peripheral circuit

CIRCUIT DESCRIPTION

System Clock Oscillation and System Reset Circuit

Microprocessor IC18 (BU18400A) requires a 2.45MHz system clock. Ceramic oscillator X2 and IC16 (TC4069 UBP) are used to generate the system clocks (figure 12).

IC15 (PST520D) is a reset IC which sends a reset signal to the microprocessor and I/O when the power supply voltage reaches about 4.3V, which halts all function immediately. When the power supply voltage exceeds approximately 4.3V, the reset signal is emitted and after the time constant set by R151 and C219 elapses, the microprocessor is initialized and operation resumes (figure 13).

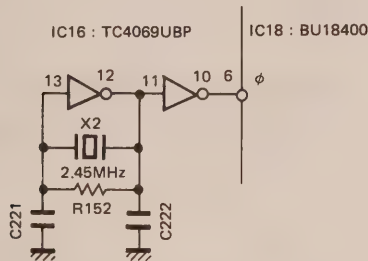


Fig. 12 System clock oscillation circuit

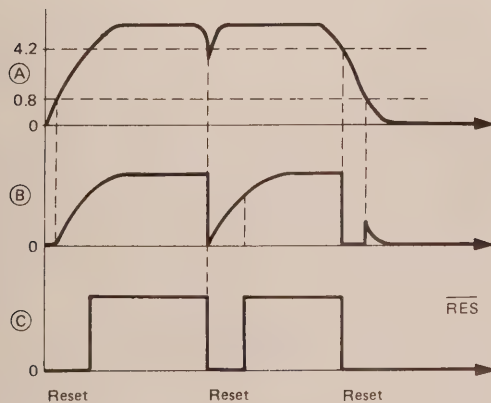
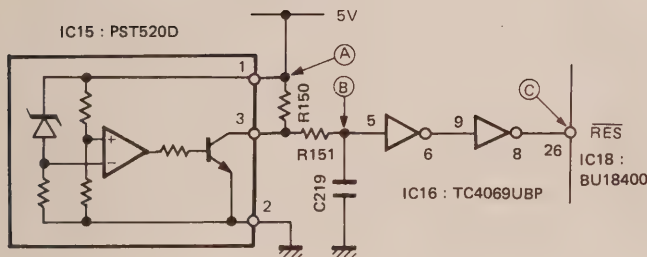


Fig. 13 Reset circuit

Address Control

Microprocessor address lines A0 to A15 cannot select ICs directly, so they are decoded into selection signals by IC19 (SN74LS138N). IC19 has a 64K-bytes memory area which is divided equally into 8 blocks (8K bytes each) and assigned to the ICs. Address control division is shown in figure 14.

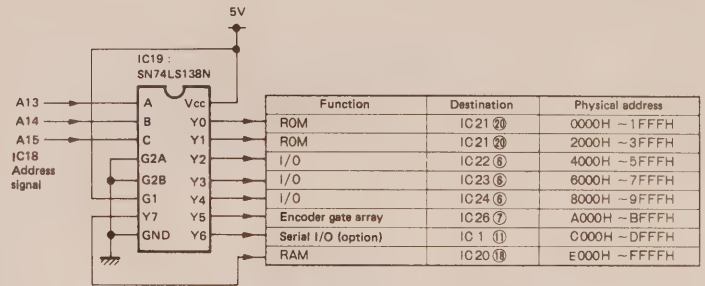


Fig. 14 Address control division

CIRCUIT DESCRIPTION

Encoder Peripheral Circuit

IC26 (LZ92K37) detects the rotational direction from the dual-phase rotary encoder pulse input, counts up or down, and has two inputs. CK1 and CK2 count all leading and trailing pulse edges, and performs quadruple functions. CK3 and CK4 count the leading and trailing edges of CK3, and performs dual functions. The main dial is an optical type, which inputs signals directly. The sub-dial is a mechanical type, which inputs signals through the chatter absorption circuit.

Count data can be read in the same manner as when reading RAM. CK1 and CK2 have one counter, CK3 and CK4 have another counter. When IC26 A0 is low, the CK1 and CK2 data is read. When A0 is high, the CK3 and CK4 data is read.

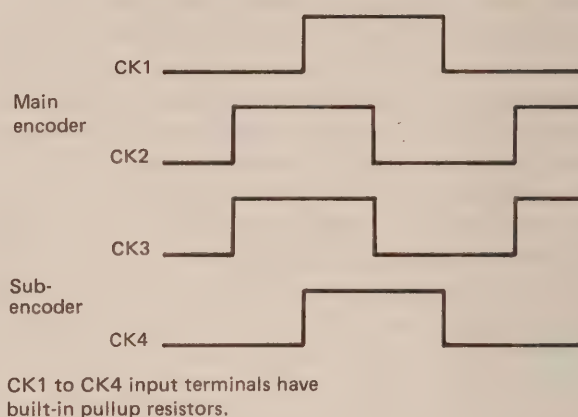


Fig. 16 Waveforms of IC26, CK1 to CK4, when the dial is turned clockwise

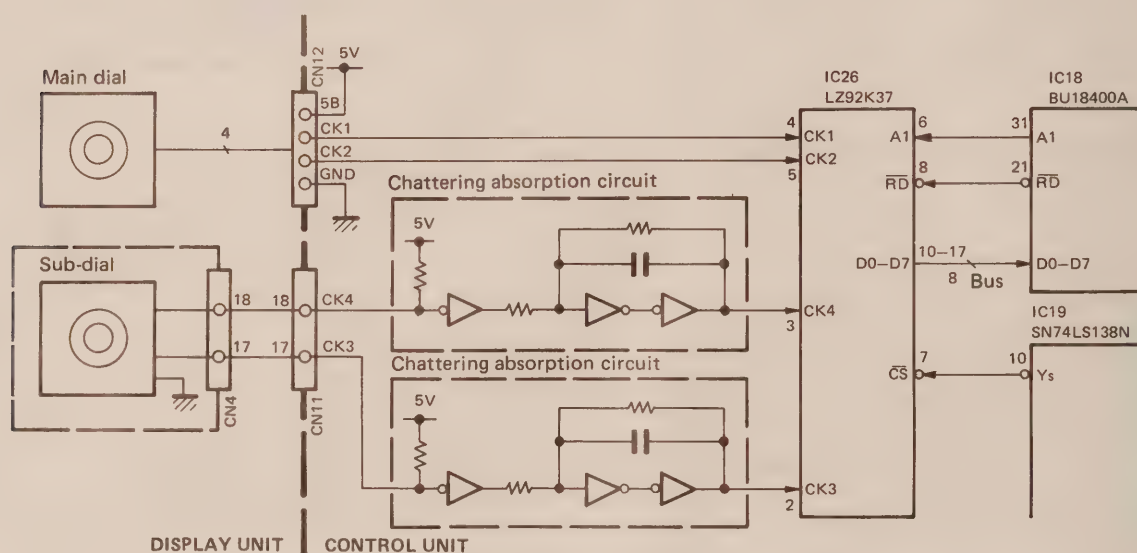


Fig. 15 Encoder peripheral circuit

Display Circuit

The fluorescent display tube is dynamically lit by IC18 (BU18400). The lighting period for one column is given by a negative pulse of IC17 (NE555C). When a low level is applied to the INT input, IC18 starts its interrupt procedure, outputs one column of display data, and the column signal to the fluorescent display tube driver MPD6300C through IC23 (TMP8255AP-5), and outputs data and control signal to the XP terminal, via IC22 port C7. Normally, one cycle ends when the data and signal are output 12 times, since there are 12 columns. However, for yellow (mode) display columns, the data and signal are output 3 times in one cycle because of a lack of sufficient intensity.

Display unit, T1, is the DC/DCE module which generates the drive voltage and filament voltage of the fluorescent display tube. The filament voltage waveform is generated by the oscillator circuit in that module. The frequency fluctuates because the column loads differ from each other, causing a variation in the oscillator frequency. The μ PD 6300C input waveforms are seen in each of the oscillator periods of IC17 (See figure 18). Data is shown in figure 19. It is output from the left.

CIRCUIT DESCRIPTION

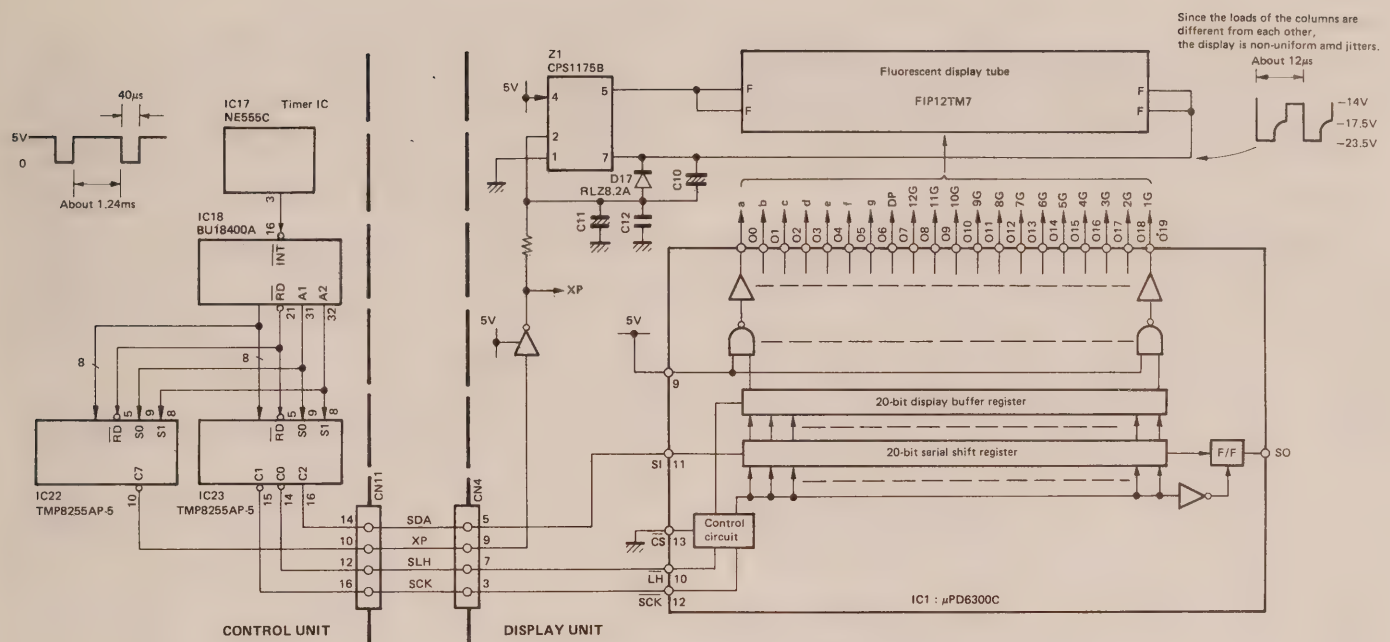


Fig. 17 Display circuit

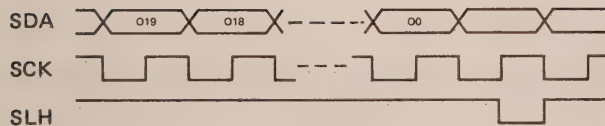


Fig. 18

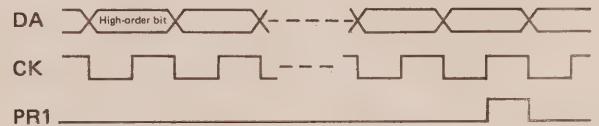


Fig. 20

G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	DP	g	f	e	d	c	b	a
----	----	----	----	----	----	----	----	----	-----	-----	-----	----	---	---	---	---	---	---	---

Fig. 19

Program counter data

N9	N8	N7	N6	N5	N4	N3	N2	N1	N0	A6	A5	A4	A3	A2	A1	A0	0
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	---

Reference division ratio data														
	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0

Fig. 21

PLL Data Output

Four PLLs are controlled. The 50kHz-step loop PLL1 uses the MB87006, and other loops use the M54927P.

Data is output for the MB87006 as shown in figure 20.

Both reference division ratio data and program counter data are given to the MB87006. Reference division ratio data are supplied only when the power is turned on. The data formats are as shown in figure 21. Data is output from the left.

Data is output to the M54927P as shown in figure 22.

Data output to the M54927P is shown in figure 23. It is output from the left.

This PLL data is output only to the PLL when changed.

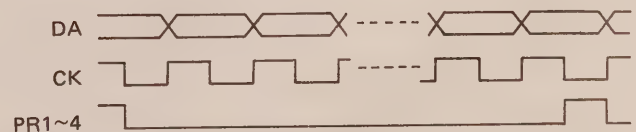


Fig. 22

M3	M2	M1	M0	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1	N0	A4	A3	A2	A1	A0
----	----	----	----	-----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Fig. 23

CIRCUIT DESCRIPTION

Band Output

The BPF and LPF are switched by output ports A0 to A4 (B0 to B4) of IC22 (TMP8255AP-5). The PLLs are switched by output ports C4 to C6 (VB1 to VB3). The levels of the ports in each frequency range are shown in the figure below:

Freq' (MHz)	B4	B3	B2	B1	B0	VB3	VB2	VB1
0 — 0.5	H	L	L	L	L	L	L	H
0.5 — 1.6	H	L	L	L	H	L	L	H
1.6 — 2.5	L	L	L	H	L	L	L	H
2.5 — 4.0	L	L	L	H	H	L	L	H
4.0 — 6.5	H	L	H	L	L	L	L	H
6.5 — 7.5	L	L	H	L	H	L	L	H
7.5 — 10.5	H	L	H	H	L	L	L	H
10.5 — 14.5	L	L	H	H	H	L	H	L
14.5 — 19.0	H	H	L	L	L	L	L	L
19.0 — 21.5	L	H	L	L	L	L	L	L
21.5 — 25.0	H	H	L	L	H	H	L	L
25.0 — 30.0	L	H	L	L	H	H	L	L
50.0 — 54.0	L	H	L	H	L	H	L	L

Table 6

A/D Converter Analog Input

The four types of analog input, RIT, IF shift, carrier point correction for LSB and USB, are A/D converted, and loaded into the microprocessor as digital values. The control unit has the A/D converter, IC27 (MB4052), to which a channel select signal (CS) and data input control signals (C0 and C1) are applied.

The microprocessor sends a channel select signal first, then a positive pulse from the A2 port of IC23 (TMP8255 AP-5) to reset the A/D converter IC27 (MB4052). After 9 clock pulses have been sent from IC23 C6 port, the converted digital values are sent from A/D converter IC27 to the C6 port of IC24: TMP8255AP-5 in synchronization with the clock pulses. The A/D converter peripheral circuit and timing charts are shown in figures 24 and 25.

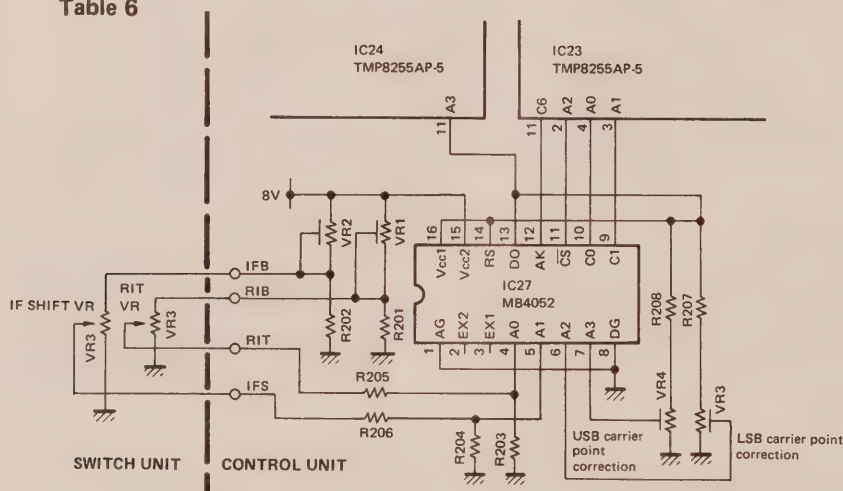


Fig. 24 A/D converter peripheral circuit

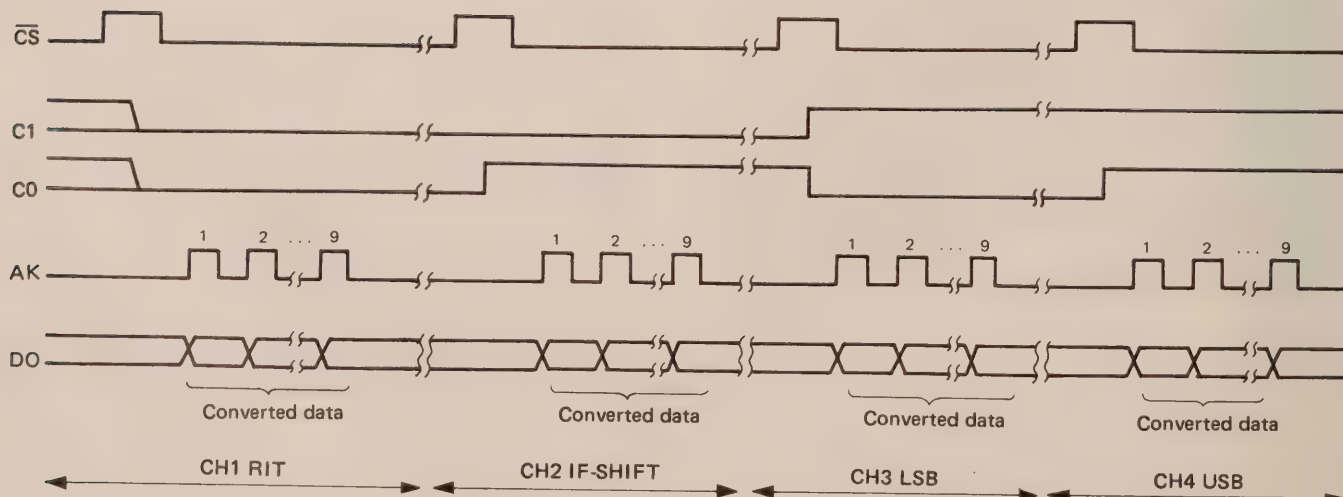


Fig. 25 A/D converter data read timing chart

CIRCUIT DESCRIPTION

Key Scan and Extended Diode

A key scan signal with a negative pulse is sent from ports B4 to B7 and C5 of IC23 (TMP8255AP-5). One column, corresponding to ports B0 to B3 of IC24 (TMP8255AP-5) is selected, and the ON/OFF state of the switch is sensed. When the switch at an intersection of the matrix is on, the corresponding bit of ports B0 to B3 of IC24 goes low, thus detecting. The activation of the switch.

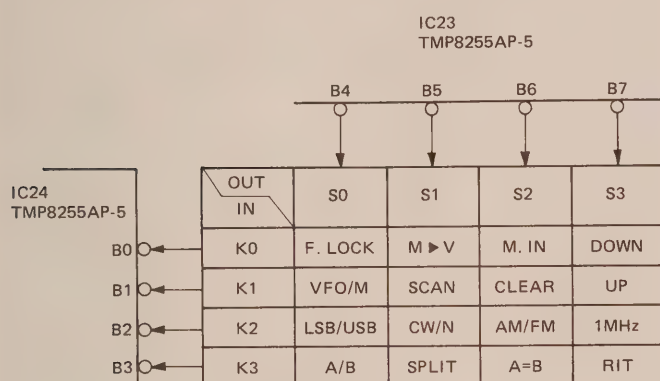


Fig. 26

Transmit Timing Control Signal

The full Break-in timing is generated by the microprocessor, and is sent as the CTX, RB, and CKY signals from port C of IC22 (TMP8255AP-5). When transmit/receive switching is detected at port A6 of IC24 (TMP8255AP-5), the CSS signal is output with the following timing.

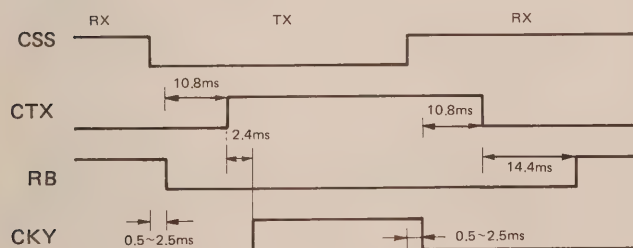


Fig. 27

SFT Output

The SFT output signal is output during FM and AM reception, and stops the CAR output.

TOB Output

The TOB output is stored in the memory channel, split channel, in FM mode, and output only during transmission. Repeater subtone control signal.

14V Input

To clear any meaningless display when the power switch is turned on or off, the 13.8V line is monitored. When this input goes low, the display is cleared.

SBK and MUT Output

This signal cuts the PLL switching noise.

I/O port functions

1) IC22 (Output only)

Terminal Name	Pin No.	Symbol	Function	Active level
A0	4	B0	Band switching output. (See the text.)	H
A1	3	B1		
A2	2	B2		
A3	1	B3		
A4	40	B4	Unused.	H
A5	39	50M		
A6	37	HFL		
A7	37	HFL		
B0	18	MUT	Cut the AF signal.	H
B1	19	PD	28MHz band power down.	H
B2	20	SBK	Cut the RF signal.	H
B3	21	CWN	Indicates CW-N.	H
B4	22	FM	Mode output.	H
B5	23	AM		
B6	24	CW		
B7	25	SSB		
C0	14	CTX	Transmit control signal. (See the text.)	H
C1	15	RB		
C2	16	CKY		
C3	17	TOB	Output the subtone (Option).	H
C4	13	PB0	PLL band switching signal. (See the text.)	H
C5	12	PB1		
C6	11	PB2		
C7	10	XP	Fluorescent display tube red letter segment signal.	L

CIRCUIT DESCRIPTION/SEMICONDUCTOR DATA

2) IC23 (Output only)

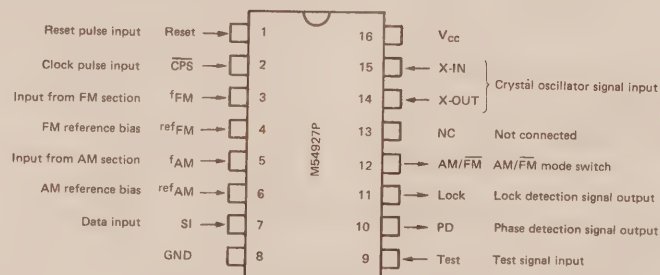
Terminal Name	Pin No.	Symbol	Function	Active level
A0	4	C0	IC27:MB4052 control signal. (See the text.)	
A1	3	C1		
A2	2	CS		
A3	1	SFT	CAR cut signal.	H
A4	40	PR1	PLL enable signal. (See the text.)	
A5	39	PR2		
A6	38	PR3		
A7	37	PR4		
B0	18	LF	F. LOCK LED signal.	H
B1	19	LM	M.SCR LED signal.	H
B2	20	L1	1MHz LED signal.	H
B3	21	—	Unused.	
B4	22	S0	Key scan output. (See the text.)	L
B5	23	S1		
B6	24	S2		
B7	25	S3		
C0	14	SLH	Fluorescent display tube drive IC signal. (See the text.)	
C1	15	SCK		
C2	16	SDA		
C3	17	EN	Unused.	
C4	13	DA	PLL data signal. (See the text.)	
C5	12	CK		
C6	11	AK	IC27:MB4052 control signal. (see the text.)	
C7	10	BZ	Turns the buzzer oscillator circuit on.	H

3) IC24 (Input only)

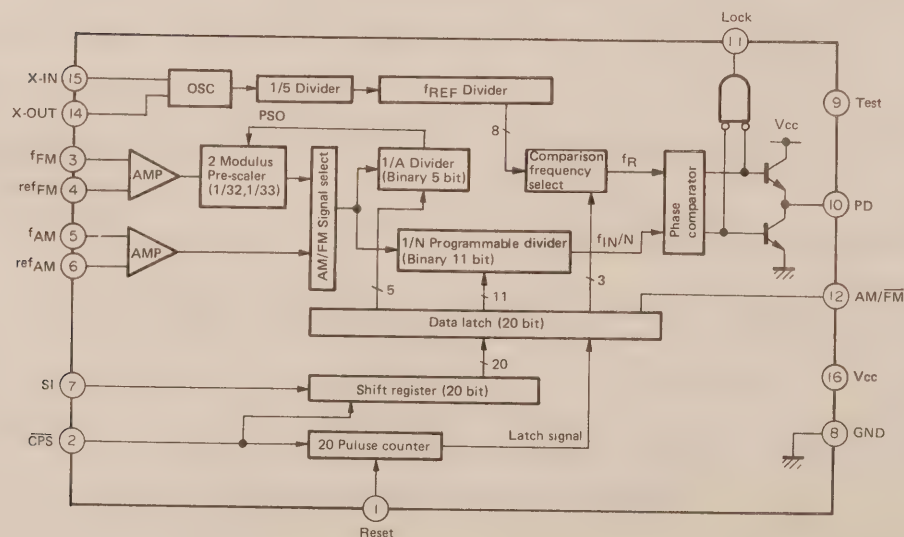
Terminal Name	Pin No.	Symbol	Function	Active level
A0	4	—	Unused.	
A1	3	—		
A2	2	UL	Detect the unlock state.	L
A3	1	AD	IC27:MB4052 data signal.	
A4	40	MU	MIC UP/DOWN switch.	L
A5	39	MD		
A6	38	CSS	CSS line signal transmission detection.	L
A7	37	14V	Power switch off detection.	L
B0	18	—	Unused.	
B1	19	—		
B2	20	—		
B3	21	—		
B4	22	—		
B5	23	—		
B6	24	—		
B7	25	—		
C0	14	—	Unused.	
C1	15	—		
C2	16	—		
C3	17	—		
C4	13	—		
C5	12	—		
C6	11	—		
C7	10	—		

M54927P : PLL IC (Control unit IC1, 4, 14)

- **Terminal connection diagram**



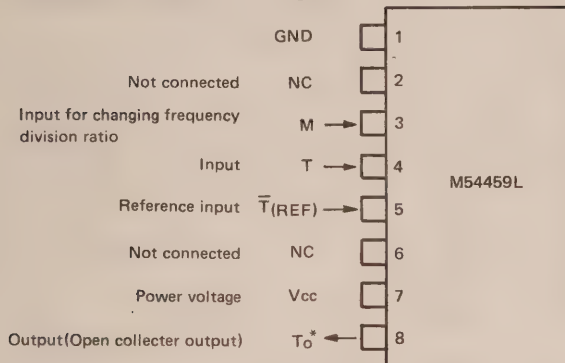
- **Block diagram**



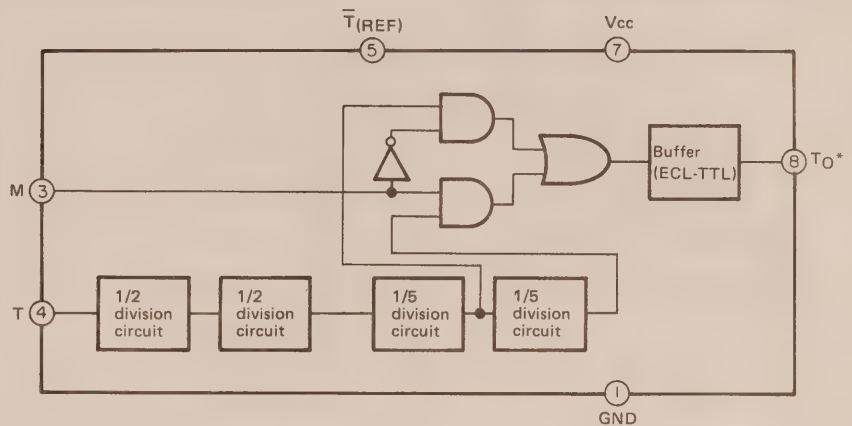
SEMICONDUCTOR DATA

M54459L : Divider (Control unit IC2)

• Terminal connection diagram



• Block diagram

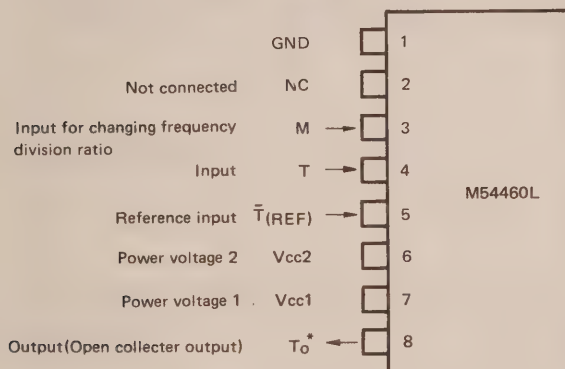


• Input for changing frequency division ratio (M) and division ratio

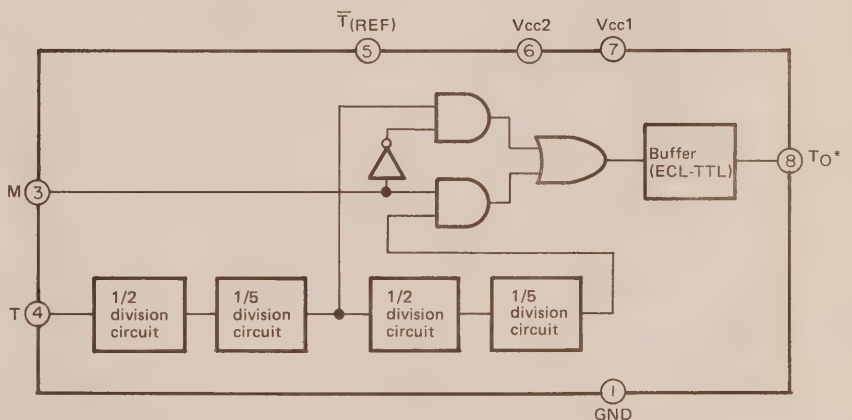
M	"L"	"H"
Division ratio	1/20	1/100

M54460L : Divider (Control unit IC5)

• Terminal connection diagram

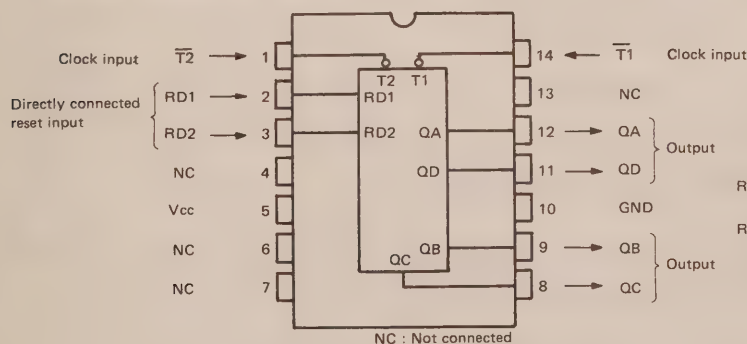


• Block diagram

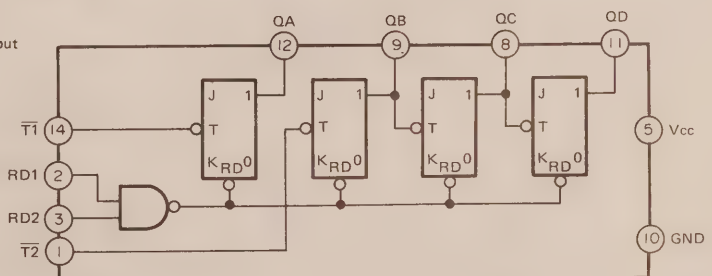


M74LS93P : Divider (Control unit IC8)

• Terminal connection diagram



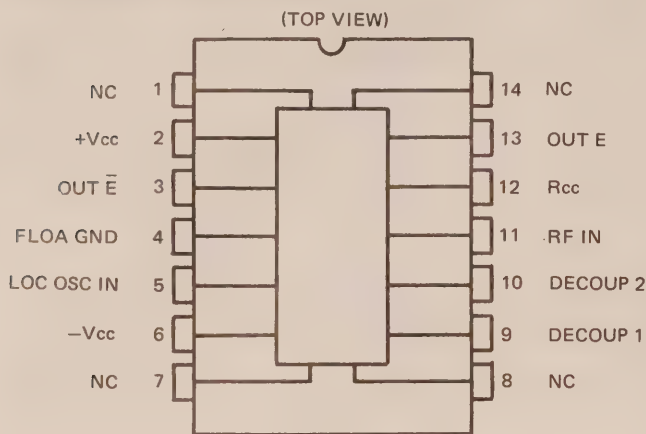
• Logic circuit



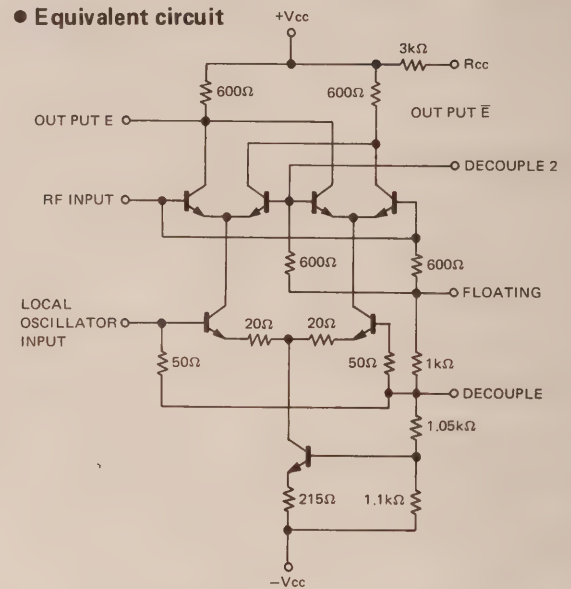
SEMICONDUCTOR DATA

SN76514N : Mixer (Control unit IC12)

• Terminal connection diagram

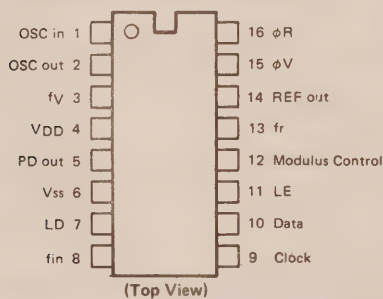


• Equivalent circuit



MB87006 : PLLIC (Control unit IC13)

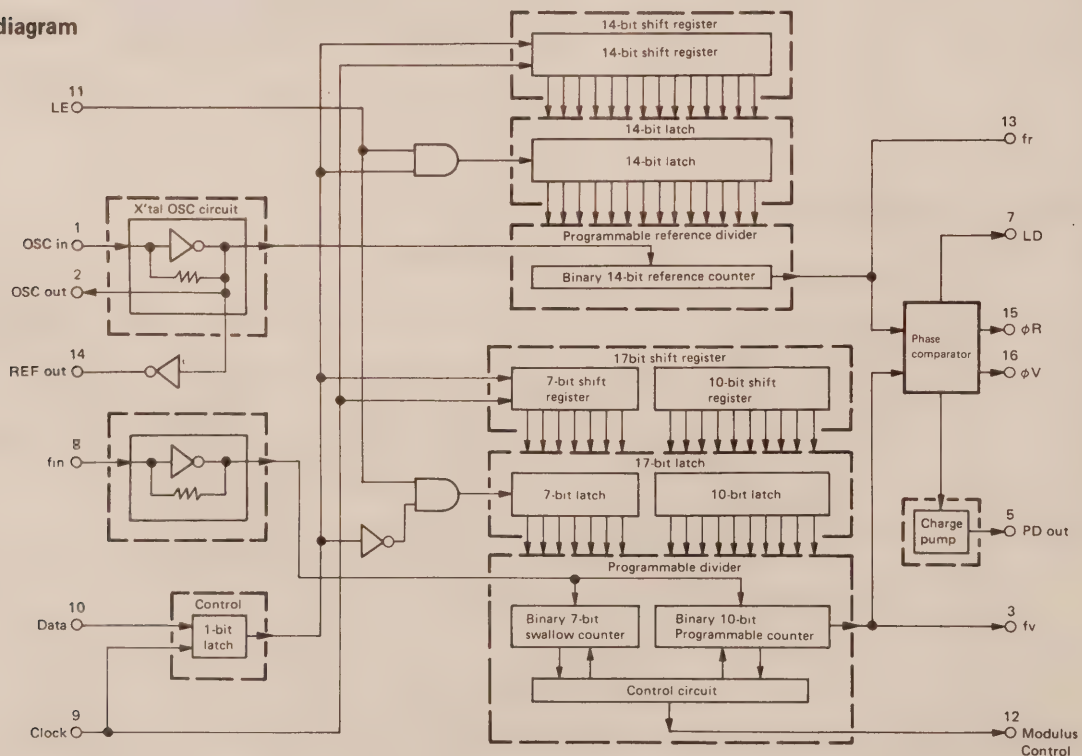
• Terminal connection diagram



• Terminal function

Terminal No.	I/O	Terminal name	Terminal No.	I/O	Terminal name
1	I	OSC in	9	I	Clock
2	O	OSC out	10	I	Data
3	O	fv	11	I	LE
4	—	VDD	12	O	Modulus Control
5	O	PD out	13	O	fr
6	—	VSS	14	O	REF out
7	O	LD	15	O	φV
8	I	fin	16	O	φR

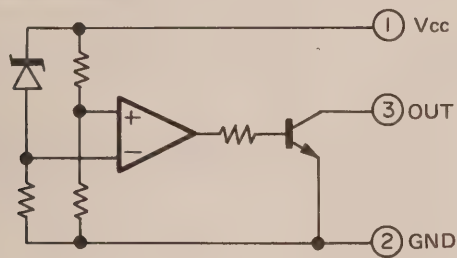
• Block diagram



SEMICONDUCTOR DATA

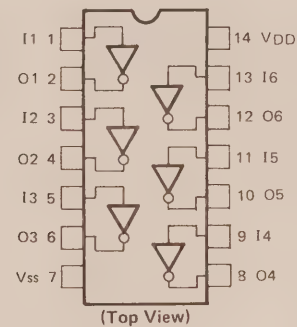
PST520D : System reset (Control unit IC15)

● Equivalent circuit



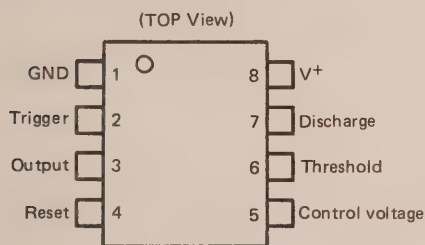
TC4069UBP : Inverter (Control unit IC16,25)

● Block diagram

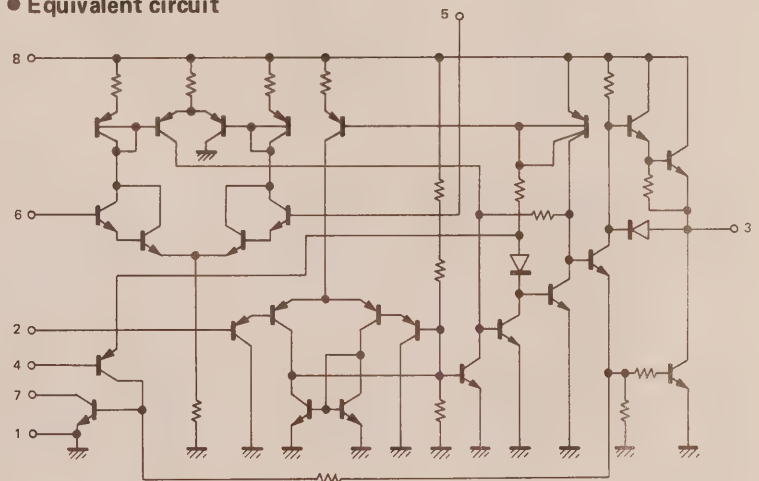


NE555C : System clock oscillator (Control unit IC17)

● Terminal connection diagram

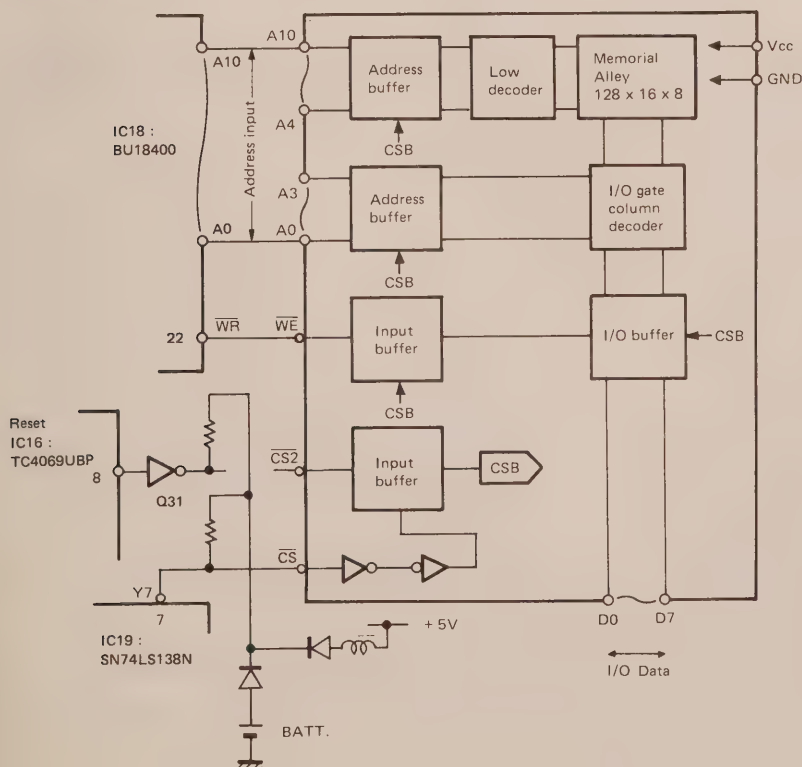


● Equivalent circuit



TC5518CPL-20 : Static RAM (Control unit IC20)

● Block diagram



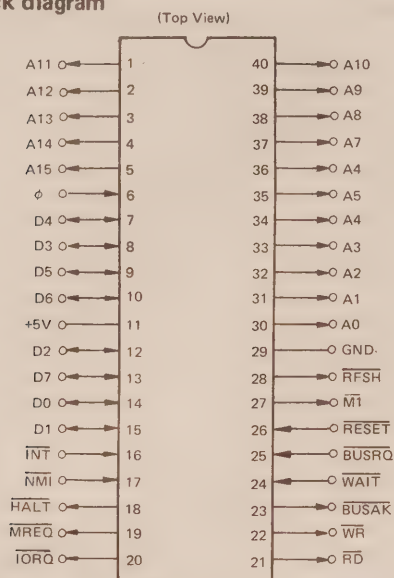
● Terminal function

Terminal name	Function
A0~A10	Address input
D0~D7	Data input/output
\overline{CS}	Chip select 1
$\overline{SC2}$	Chip select 2
\overline{WE}	Write enable
Vcc	Power supply (+ 5V)
GND	Ground

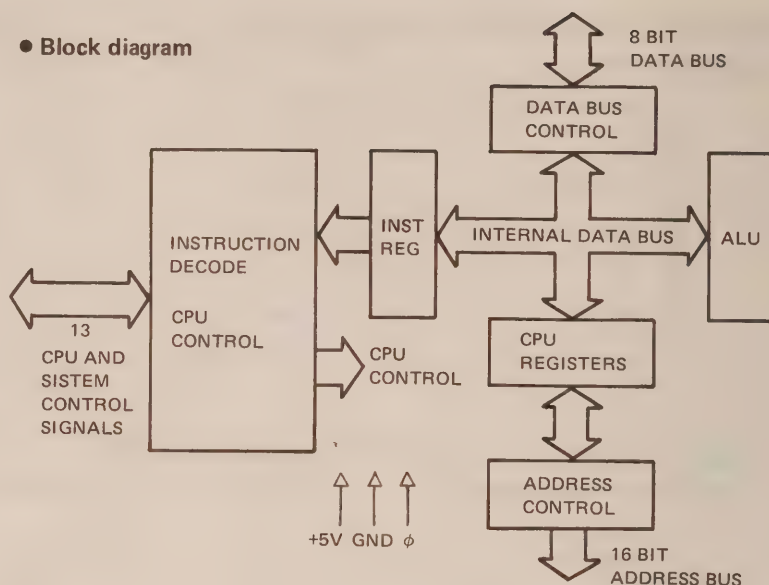
SEMICONDUCTOR DATA

BU18400A : CPU (Control unit IC18)

● Block diagram



● Block diagram



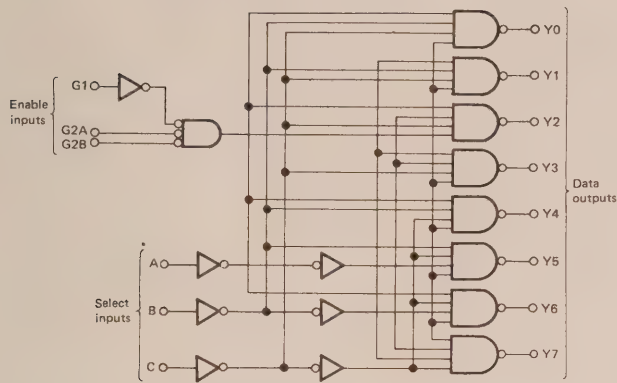
● Terminal function

Terminal (Signal) name	Input/Output	Terminal (Signal) function
A0 ~ A15 (Address Bus)	3-state output Active "H"	16-bit address bus. Outputs address of memory or I/O device No.. When memory is refreshed, refreshed address is output to seven bits at lower places.
D0 ~ D7 (Data Bus)	3-state Input/output Active "H"	8-bit data bus. Used to transfer data between memory or I/O device and CPU.
M1 (Machin Cycle one)	Output Active "L"	Signal which indicates started machine cycle is OP code fetch cycle.
MREQ (Memory Request)	3-state output Active "L"	Signal which indicates address information necessary for reading and writing memory is output to address bus.
IORQ (Input/Output Request)	3-state output Active "L"	During M1 cycle This signal request outside devices to add interruption response vector to data bus when maskable interruption is acknowledged. Out of M1 cycle This signal indicates I/O device No. necessary for reading and writing I/O is output to the address bus.
RD (Read)	3-state output Active "L"	Signal which indicates data is being input in data bus. Memory or I/O device sends data to the data bus, synchronizing with this signal.
WR (Write)	3-state output Active "L"	Signal which indicates data is being output by data bus. Data to be sent to memory or I/O device is supplied to data bus, synchronizing with this signal.
RFSH (Refresh)	Output Active "L"	Signal which indicates refreshed address for dynamic RAM is output to seven bits at lower places of address during M1 cycle. Dynamic RAM reads refreshed address by using MREQ signal output at the same time as RFSH signal.
HALT (Halt State)	Output Active "L"	Signal which indicates HALT command is executed and CPU is set under HALT condition. When returning from HALT condition, any one of INT, NM1 or RESET signals is necessary. CPU continues to refresh memory executing NOP command during HALT.
WAIT (Wait)	Input Active "L"	While this signal is active, CPU continues to wait. If this signal is used, low-speed memory or I/O device can be directly connected to CPU. While CPU is waiting, memory is not refreshed.
INT (Interrupt Request)	Input Active "L"	Input terminal for interruption request signal. If this signal becomes active while interruption is permitted, CPU starts interruption program after finishing command being executed.
NMI (Non Maskable Interrupt)	Input Negative edge trigger	Input terminal for nonmaskable interruption request signal. If this signal becomes active, CPU jumps to address 0066 (16) after finishing command being executed, regardless of permission of interruption. Priority higher than INT signal is given to NM1 signal.
RESET (Reset)	Input Active "L"	If this signal becomes active, CPU is reset.
BUSRQ (Bus Request)	Input Active "L"	If this signal becomes active, CPU heighten impedance of address bus (A0 ~ A15), data bus (D0 ~ D7) and 3-state system control terminals (MREQ, IORQ, RD, and WR). Thus, other devices can use above external buses. Priority higher than NM1 signal is given to BUSRQ signal.
BUSAK (Bus Acknowledge)	Output Active "L"	Signal which indicates CPU has received BUSRQ signal and heightened impedance of address bus, data bus and 3-state system control terminal.
ϕ (Clock)	Input	+5V single-phase clock input terminal.

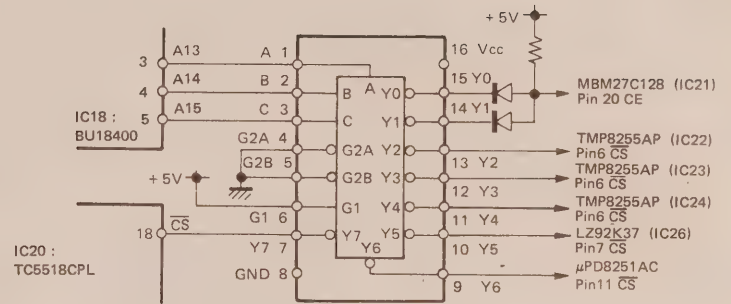
SEMICONDUCTOR DATA

SN74LS138N : Address decoder (Control unit IC19)

● Logic circuit



● Block diagram



● Truth table

INPUT					OUTPUT							
Enable		Select										
G1	G2	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

Note 1 : $G2 = G2A + G2B$

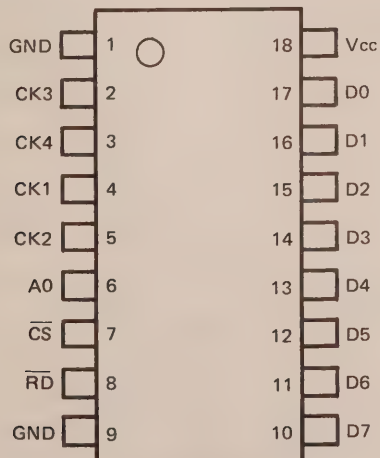
Note 2 : H : High level

L : Low level

X : Either "H" or "L"

LZ92K37 : Counter (Control unit IC26)

● Terminal connection diagram



● Terminal function

Pin No.	I/O	Signal name	Pin No.	I/O	Signal name
1	—	GND	10	TO	D7
2	Icu	CK3	11	TO	D6
3	Icu	CK4	12	TO	D5
4	Icu	CK1	13	TO	D4
5	Icu	CK2	14	TO	D3
6	Ic	A0	15	TO	D2
7	Ic	CS	16	TO	D1
8	Ic	RD	17	TO	D0
9	—	GND	18	—	Vcc

Ic : C-MOS level input buffer

Icu : Input buffer with C-MOS level pull-up resistance

TO : Tristate output buffer

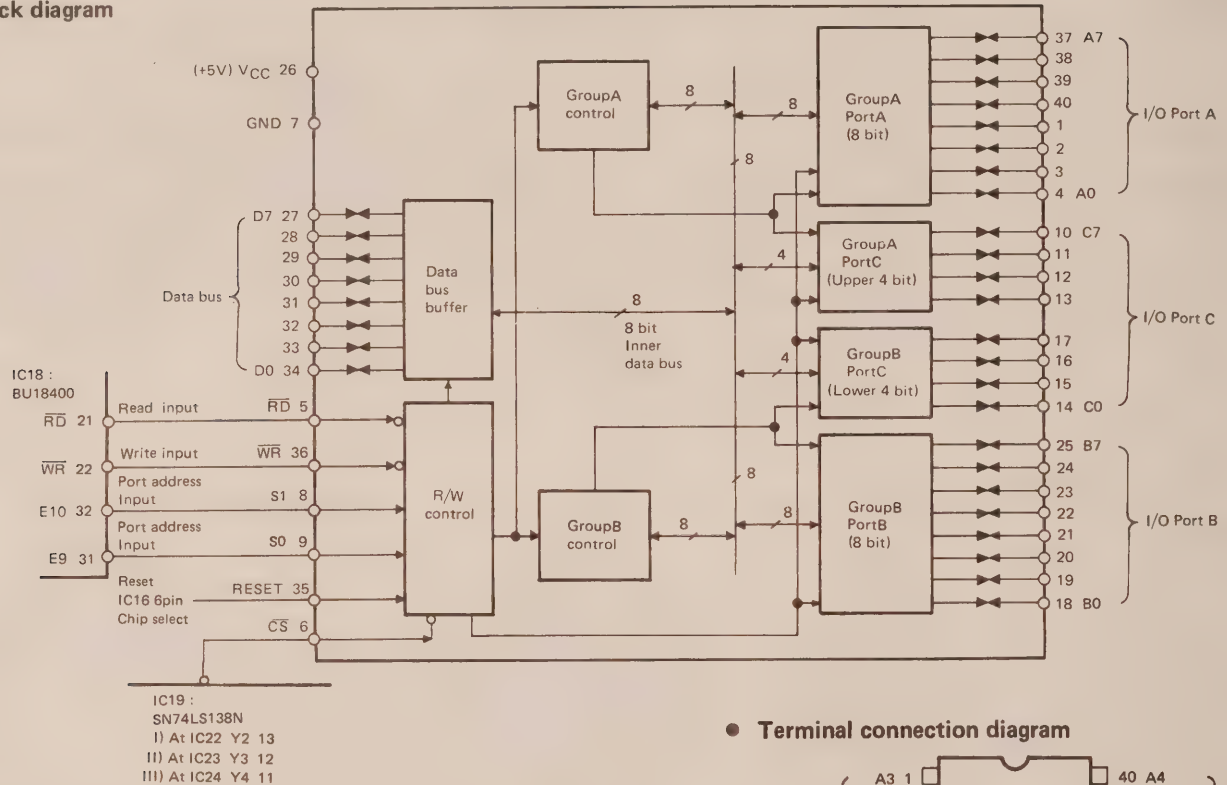
● Terminal function

Terminal name	Terminal function
CK1, 2	Rotary encoder pulse input
CK3, 4	Rotary encoder pulse input
A0	Output data selection input, 0 = CK1, 2 1 = CK3, 4
CS	Chip select input
RD	Read enable input
D0 ~ D7	Data bus output

SEMICONDUCTOR DATA

TMP8255AP-5 : I/O Port (Control unit IC22~24)

● Block diagram

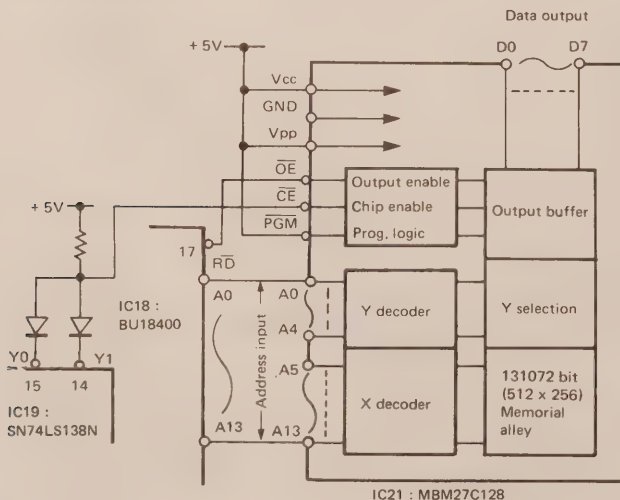


● Basic function

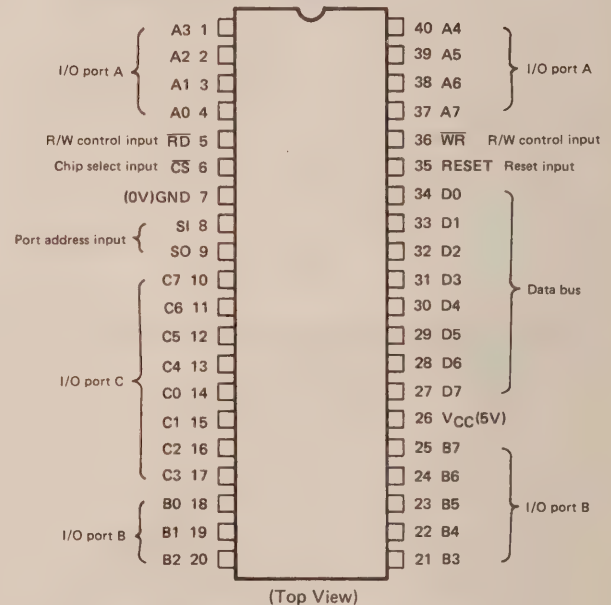
SI	SO	CS	RD	WR	Function
L	L	L	L	H	Data bus ← Port A
L	H	L	L	H	Data bus ← Port B
H	L	L	L	H	Data bus ← Port C
L	L	L	H	L	Port A ← Data bus
L	H	L	H	L	Port B ← Data bus
H	L	L	H	L	Port C ← Data bus
H	H	L	H	L	Control register ← Data bus
—	—	H	—	—	Data bus is in the high-impedance state.
H	H	L	L	H	Prohibit assortment

MBM27C128-25JA2 : ROM (Control unit IC21)

● Block diagram



● Terminal connection diagram



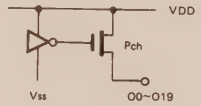
● Terminal function

Terminal name	Function
A0~A13	Address input
D0~D7	Data output
CE	Chip enable input
OE	Output enable input
PGM	Program input
Vcc	Power supply
Vpp	Program power supply
GND	Ground

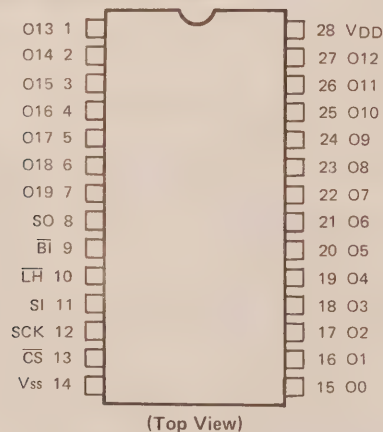
SEMICONDUCTOR DATA

μPD6300C : Fluorescent display tube driver (Display unit IC1)

● Terminal function

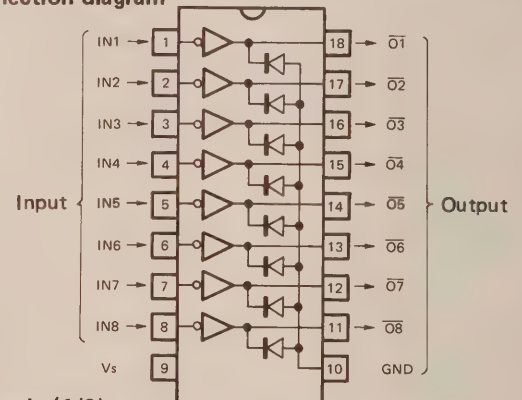
Terminal No.	Symbol	Terminal name	I/O	Function
1~7	O13~O19	FIP segment driver	O	High dielectric-strength (40V) output in the Pch open. Corresponds to the output of O13~O19.
8	SO	Serial data output pin	O	Output serial data the trailing edge of SCK, when the n-number of μPD6300Cs are connected in series, this can be connected to the SI of the following stage.
9	BI	Blanking pin	I	This input can turn off all indicator or displays, and can dim them by applying a random duty pulse from outside. Active low.
10	LH	Latch pin	I	Transmits the connects of the serial shift register to the buffer register at low level, to latch the connects at the rising time. Active rising (leading) edge.
11	SI	Serial data input pin	I	This is the data input pin. Inputs data to the shift register at the rising edge of SCK.
12	SCK	Serial clock input pin	I	Reads out the SI data to the shift register at the rising edge of SCK. Outputs data from SO at the trailing edge of SCK.
13	CS	Chip select pin	I	When CS is high, this inhibits SCK and LH, and when CS is low, activates SCK and LH.
14	Vss	GND	—	Connect to the GND terminal of the system.
15~27	O0~O12	FIP segment driver	O	Pch open-drain system, high dielectric-strength output. Corresponds to the output of O0~O12. 
28	VDD	Power supply pin	—	5V ± 10%

● Terminal connection diagram

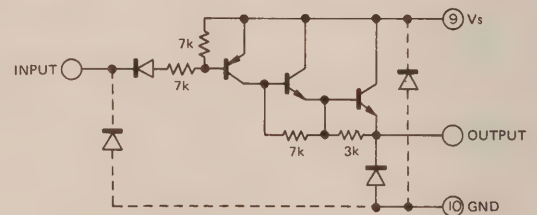


M54581P : Band data driver (Signal unit IC1)

● Terminal connection diagram

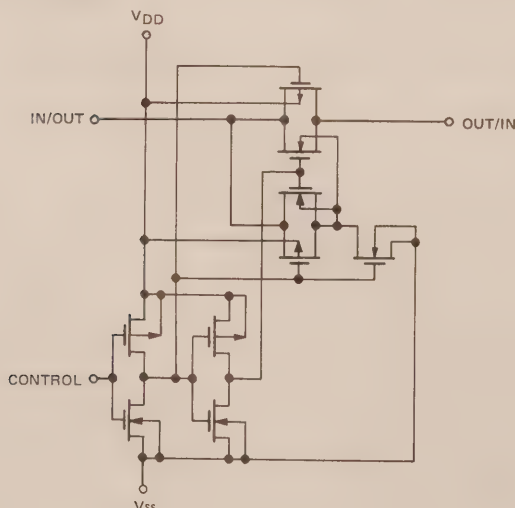


● Equivalent circuit (1/8)

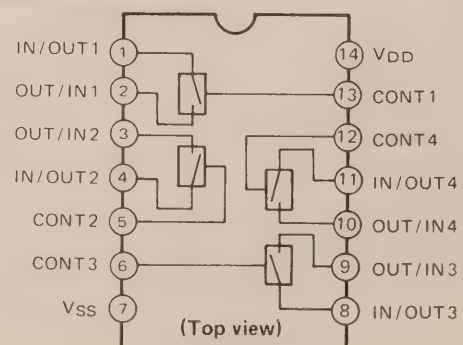


TC4066BP : Switch (Signal unit IC7~10)

● Equivalent circuit (1/4)



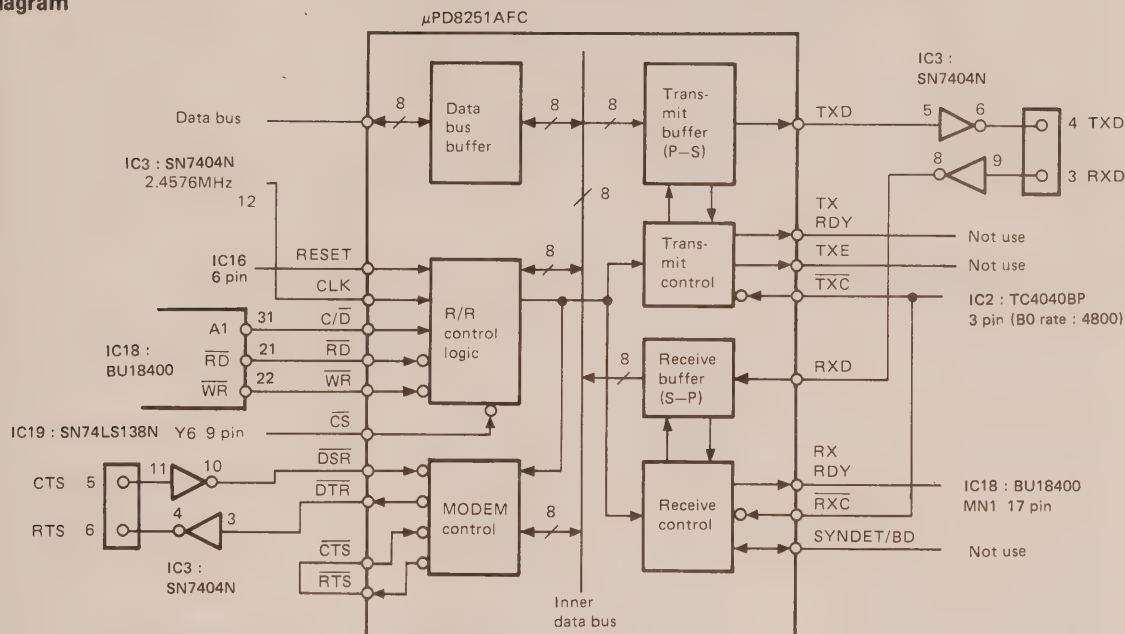
● Terminal connection diagram



SEMICONDUCTOR DATA

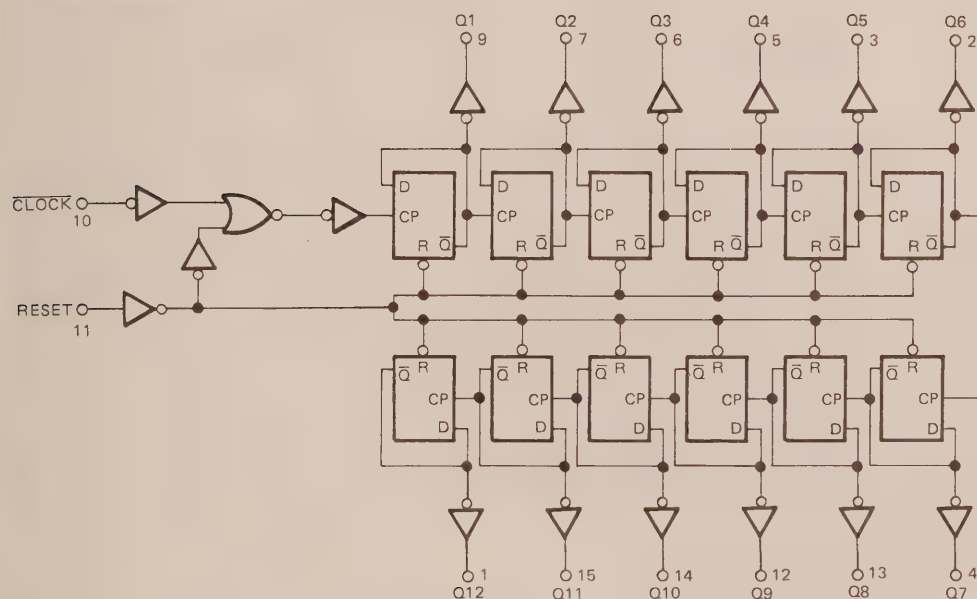
μPD8251AFC (Option IF-10C IC1)

● Block diagram



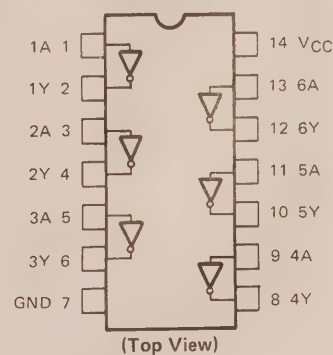
TC4040BP (Option IF-10C IC2)

● Block diagram



HD7404P (Option IF-10C IC3)

● Block diagram



(Top View)

DESCRIPTION OF COMPONENTS

SWITCH UNIT (X41-3030-XX)

Component	Use/Function	Operation/Condition/Compatibility
IC1	Microphone amplifier	Processing of audio signals, speech processor.
Q1	Switching transistor	Q1 is ON when PRS is "H".
Q2~4	Switching transistor	Q2~4 are ON when PKS is "L".
Q5	Amplification of control signal	
Q6	Amplifier	For VOX. TS-140S only
D1	Detection of control signal	
D2,3	Switching diode	D2 is ON when RXB is "H". D3 is ON when PKS is "L".

100W FINAL UNIT (X45-3100-XX)

Component	Use/Function	Operation/Condition/Compatibility
Q1	Pre-drive amplifier	Wide-band amplification of HF band.
Q2,3	Drive amplifier	Push-pull wide-band amplification of HF band.
Q4,5	Final amplifier	Push-pull wide-band amplification of HF band.
Q6	Supply of bias for drive	Temperature compensation of drive.
Q7	Supply of bias for final	Temperature compensation of final.
Q8	Constant-voltage power supply	5V for digital system.
Q9	Constant-voltage power supply	5V for PLL system.
D1	Temperature compensation	Temperature sensing of pre-drive.
D2	Temperature compensation	Temperature sensing of drive.
D3	Temperature compensation	Temperature sensing of final.
D4	Absorption of surge voltage	Relay for changing over HF and VHF of drive. TS-680S only
D5	Absorption of surge voltage	For fan motor.
D6	Protection of inverse connection	For power supply terminal.
D7	Constant-voltage power supply	Power supply of 8.2V for temperature sensor module.

FILTER UNIT (X51-3040-XX)

Component	Use/Function	Operation/Condition/Compatibility
Q1	Drive amplifier of 50MHz band	TS-680S only
Q2	Final amplifier of 50MHz band	TS-680S only
Q3	Switching of RAT	Grounds receiving antenna terminal when transmitting.
D1	Absorption of surge voltage of relay	For relay of 500kHz~2.5MHz LPF.
D2	Absorption of surge voltage of relay	For relay of 2.5MHz~4.0MHz LPF.
D3	Absorption of surge voltage of relay	For relay of 4.0MHz~7.5MHz LPF.
D4	Absorption of surge voltage of relay	For relay of 7.5MHz~14.5MHz LPF.
D5	Absorption of surge voltage of relay	For relay of 14.5MHz~21.5MHz LPF.
D6	Absorption of surge voltage of relay	For relay of 21.5MHz~30MHz LPF.
D7	Absorption of surge voltage of relay	For relay of 50MHz~54MHz LPF. TS-680S only
D8	Absorption of surge voltage of relay	For changeover of TX and RX.
D9	Rectification of traveling wave	High-frequency rectification.
D10	Rectification of reflected wave	High-frequency rectification.
D11	Protection from lightning surge	Surge absorber of receiving antenna terminal.

DESCRIPTION OF COMPONENTS

CONTROL UNIT (X53-3100-XX)

VCO1-D mode is TS-680S only

Component	Use/Function	Operation/Condition/Compatibility
IC1	PLL3 (BFO PLL)	1,2,7: Frequency division ratio setting input. 3: 91MHz input (VCO3) in AM mode. 10: VCO lock voltage output. 11: UL line. "L" in UL mode. 15: 4.5MHz input (1/8 fSTD).
IC2	Frequency divider (1/20)	4: 91MHz input. 8: 4.55MHz output.
IC3	Frequency divider (1/10)	1: 4.55MHz input. 2: SFT line. Output is OFF when "H" is input. 12: 455kHz output.
IC4	PLL2 (VFO 10Hz step for covering 50kHz)	1,2,7: Frequency division ratio setting input. 3: 55~60MHz input (VCO2). 10: VCO lock voltage output. 11: UL line. "L" in UL mode. 15: 4.5MHz input (1/8 fSTD).
IC5	Frequency divider (1/10)	4: 55~60MHz input. 8: 5.5~6.0MHz output.
IC6	Mixer (MIX5)	1: 10.05~10.55MHz output. 2: 5.5~6.0MHz input. 5: 4.55MHz input.
IC7	Frequency divider (1/10)	1: 10.05~10.55MHz input. 12: 1.005~1.055MHz output.
IC8	Frequency divider (1/8)	8: 4.5MHz output (1/8 fSTD). 14: Input of reference frequency of 36MHz (fSTD).
IC9	Mixer (MIX4)	1: 5.505~5.555MHz output. 2: 1.005~1.055MHz input. 5: 4.5MHz output.
IC10	Mixer (MIX3)	1: 41.505~41.555MHz output. 2: 5.505~5.555MHz input. 5: 36MHz input.
IC11	Mixer (MIX2)	1: Output of 37.005~37.055MHz (in VCO1-A mode) or 77.505~77.555MHz (in VCO1-C,D mode). 2: 41.505~41.555MHz input. 5: Input of 4.5MHz (in VCO1-A mode) or 36MHz (in VCO1-C,D mode).
IC12	Mixer (MIX1)	3: Output of 3.55~13.5MHz (in VCO1-A mode) or 9.05~20.0MHz (in VCO1-B mode) or 15.95~7.5MHz (in VCO1-C mode) or 12.55~16.5MHz (in VCO1-D mode). 5: Input of 40.555~50.555MHz (in VCO1-A mode) or 50.555~61.555MHz (in VCO1-B mode) or 61.555~70.055MHz (in VCO1-C mode) or 90.055~94.055MHz (in VCO1-D mode). 11: Input of 37.005~37.055MHz (in VCO1-A mode) or 41.505~41.555MHz (in VCO1-B mode) or 77.505~77.555MHz (in VCO1-C mode).
IC13	PLL1 (VFO 50kHz step, last VCO)	1: 4.5MHz input (1/8 fSTD). 5: VCO lock voltage output. 7: UL line. "L" in UL mode. 8: Input of 3.55~13.5MHz (in VCO1-A mode) or 9.05~20.0MHz (in VCO1-B mode) or 15.95~7.5MHz (in VCO1-C mode) or 12.55~16.5MHz (in VCO1-D mode). 9,10,11: Frequency division ratio setting input. 13: Signal for 50kHz output marker.

DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
IC14	PLL4 (HET PLL)	1,2,7: Frequency division ratio setting input. 3: 39.6MHz input (VCO4). 10: VCO lock voltage output. 11: UL line. "L" in UL mode. 15: 4.5MHz input (1/8 f _{STD}).
IC15	System reset	Generates reset signal when source voltage rises or lowers to make timing of operation and backing up of microprocessor.
IC16	Inverter	1/6, 2/6: Beep tone oscillator. 3/6, 4/6: Shaping of system reset signal wave form. 5/6, 6/6: System clock oscillator (2.45MHz).
IC17	System clock oscillation	Generates interrupt signal for dynamic lighting of indicator lamp.
IC18	CPU	8-bit microprocessor, Z80 (See CIRCUIT DESCRIPTION).
IC19	Address decoder	Divides address signal of CPU and converts chip select signal of each IC and divides memory area of 64kbytes into 8kbytes x 8blocks.
IC20	Static RAM	Makes data such as VFO, memory, etc. for microprocessor. Area capacity: 2kbytes x 8bits. Backed up by system reset signal.
IC21	ROM	Control program (including program for outside control) is built in. Area capacity: 16kbytes x 8bits.
IC22,23	I/O port	Bus interface I/O port. All are set by output ports. (See I/O PORT FUNCTIONS.)
IC24	I/O port	Bus interface I/O port. All are set by input ports. (See I/O PORT FUNCTIONS.)
IC25	Inverter	Absorbs chattering of encoder.
IC26	Counter	Counts pulses of encoder. Two system of quadruplication (CK1,2) and duplication (CK3,4).
IC27	A/D converter	Converts analog voltage input to digital data and output it. 4: RIT. 5: IF shift. 6: Carrier point (LSB) compensation. 7: Carrier point (USB) compensation.
Q1	VCO3 (PLL3)	90.7~91.3MHz.
Q2	VCO3 buffer	
Q3,4	BFO buffer	453.5~456.5kHz.
Q5	VCO2 (PLL2)	55.0~60.0MHz.
Q6	VCO2 buffer	
Q7	MIX5 output amplifier	10.05~10.55MHz.
Q8	TTL input buffer	
Q9	Reference crystal oscillation (OSC)	36MHz (f _{STD}).
Q10	OSC buffer	
Q11	TTL input buffer	
Q12	MIX3 input buffer	36MHz
Q13	MIX1 input buffer	37.005~37.055MHz (VCO1-A mode) or 41.505~41.555MHz (VCO1-B mode) or 77.505~77.555MHz (VCO1-C,D mode).
Q14	VCO1 buffer	40.555~70.055MHz or 90.055~94.055MHz.
Q15	PLL IF signal amplification	2.5~22.5MHz.
Q16~18	PLL1 low-pass filter	Active (Reference frequency: 50kHz).
Q19~21	PLL4 low-pass filter	Active (Reference frequency: 5kHz or 25kHz).
Q22	VCO4 (PLL4)	39.6MHz.
Q23	VCO4 buffer	
Q24	HET buffer	
Q25,26	Shaping of UL signal wave form	Output is "L" in UL mode.

DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
Q27	BPF (PLL) buffer	MIX1 input of 37.005~37.055MHz in VCO1-A mode.
Q28	BPF (PLL) buffer	MIX1 input of 41.505~41.555MHz in VCO1-B mode.
Q29	BPF (PLL) buffer	MIX1 input of 77.505~77.555MHz in VCO1-C,D mode.
Q30	Outside interrupt control	Transfers to program for outside control of personal computer.
Q31	RAM backup control	Transfers to backup mode of RAM when power is OFF.
Q32	BPF (PLL) buffer	Active is "H" in VCO1-C,D mode.
Q33	BPF (PLL) buffer and VCO1-B buffer	Active is "H" in VCO1-B mode.
Q34	BPF (PLL) buffer and VCO1-A buffer	Active is "H" in VCO1-A mode.
Q35	TONE UNIT signal buffer	Active is "H" in FM transmission mode of split memory CH.
Q36	SSB mode signal buffer	Active is "H" in SSB mode.
Q37	CW mode signal buffer	Active is "H" in CW mode (including CWN mode).
Q38	AM mode signal buffer	Active is "H" in AM mode.
Q39	FM mode signal buffer	Active is "H" in FM mode.
Q40	CWN mode signal buffer	Active is "H" in CWN mode.
Q41	MSCR LED driver	Drives LED when momory is scrolling.
Q42	F.LOCK LED driver	Drives LED in F.LOCK mode.
Q43	1MHz LED driver	Drives LED in 1MHz mode.
D1	VCO3 varicap	Frequency variable.
D2,3	VCO2 varicap	Frequency variable.
D4,5	BPF changeover switch	ON in VCO1-B mode.
D6	BPF changeover switch	ON in VCO1-A,C,D mode.
D7,8	Wired OR	"H" in VCO1-A,C,D mode.
D9,10	LPF changeover switch	ON in VCO1-C,D mode.
D11	LPF changeover switch	ON in VCO1-A mode.
D12,13	BPF changeover switch	ON in VCO1-C,D mode.
D14,15	BPF changeover switch	On in VCO1-A mode.
D16	Wired OR	Composition of PLL1, UL signal.
D17	VCO4 varicap	Frequency variable.
D18	Beep switch	Beep oscillator is turned ON/OFF by beep pulse. Active is "H".
D19,20	Composition of ROM chip select	Makes 2 blocks of select signal of 8kbytes and use them as ROM select signal of 16kbytes.
D21,23,24	Power supply changeover switch	Changes power supply in RAM backup mode.
D22	Stabilization of voltage	For Lithium battery.
D25~27	Prevention of reverse current	
D29,31	Extended function switch	

DESCRIPTION OF COMPONENTS

DISPLAY UNIT (X54-3050-XX)

Component	Use/Function	Operation/Condition/Compatibility
IC1	Serial input-type high-voltage fluorescent indicator lamp	Converts serial indication data from CONTROL UNIT in parallel and turns on fluorescent indicator lamp.
Q1	Fluorescent indicator lamp driver	
D1	Switching	F.LOCK
D2	Switching	M ► V
D3	Switching	M.IN
D4	Switching	DOWN
D5	Switching	VFO/M
D6	Switching	SCAN
D7	Switching	CLEAR
D8	Switching	UP
D9	Switching	USB/LSB
D10	Switching	CW (N/W)
D11	Switching	FM/AM
D12	Switching	1 MHz
D13	Switching	A/B
D14	Switching	SPLIT
D15	Switching	A=B
D16	Switching	RIT
D17	Generation of filament bias voltage	Generates bias for filament of fluorescent indicator lamp.
D18	Indication	Turns on red lamp in transmission mode.
D19	Indication	Turns on yellow lamp when M.SCR is ON.
D20	Indication	Turns on green lamp when F.LOCK is ON.
D21	Indication	Turns on green lamp when 1 MHz is ON.

SIGNAL UNIT (X57-3190-00: TS-680S) (X57-3200-XX: TS-140S)

Component	Use/Function	Operation/Condition/Compatibility
IC1	Band data driver	13.8V output.
IC2	Decoding of band data	Open collector. Active is "L".
IC3	RX: Product detection, TX: BM	455kHz↔AF.
IC4	Audio power amplifier	
IC5	TX 1st mixer	455kHz→40.055MHz.
IC6	FM IF amplifier, detection, squelch	
IC7 (1/4)	DC switch	Turned ON in TX mode.
IC7 (2/4)	AF signal switch	Turned ON in SSB and CW mode.
IC7 (3/4)	AF signal switch	Turned ON in FM mode.
IC7 (4/4)	AF signal switch	Turned ON in AM mode.
IC8 (1/4)	AGC time constant switch	Turned ON in AM mode.
IC8 (2/4)	AGC time constant switch	Turned ON in AGC and SLOW mode.
IC8 (3/4)	Changeover switch of meter	Turned ON in TX/ALC mode.
IC8 (4/4)	Changeover switch of meter	Turned ON in TX/PWR mode.
IC9 (1/4)	S-meter sensitivity switch	Turned ON in 50MHz band mode.
IC9 (2/4)	S-meter sensitivity switch	Turned ON in HF mode.
IC9 (3/4)	Changeover switch of meter	Turned ON in RX mode.
IC9 (4/4)	S-meter sensitivity switch	Turned ON in FM mode.
IC10 (1/4)	ALC level switch	Turned ON in AM and CW mode.
IC10 (2/4)	ALC level switch	Turned ON in SSB mode.
IC10 (3/4)	ALC level switch	Turned ON in power-down mode.
IC10 (4/4)	ALC level switch	Turned ON in mode other than power-down mode.
IC11 (1/4)	ALC amplifier	
IC11 (2/4)	Reflected wave voltage amplifier	
IC11 (3/4)	Detected output amplifier	Amplifies voltage of traveling wave and reflected wave.
IC11 (4/4)	Power meter amplifier	
IC12	8V AVR	

DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
Q1	13.8V line switching	Turned ON in 2MHz band mode.
Q2	13.8V line switching	Turned ON in 50MHz band mode. TS-680S only
Q3,4	Switching	Turned "L" in 50MHz band mode. TS-680S only
Q5	8V line switching	Turned ON in 50~54MHz mode. TS-680S only
Q6	8V line switching	Turned ON in 21.5~30.0MHz mode.
Q7	8V line switching	Turned ON in 10.5~21.5MHz mode.
Q8	8V line switching	Turned ON in 0.5~10.5MHz mode.
Q9~11	VCO	Q9: 0.5~10.5MHz Q10: 10.5~21.5MHz Q11: 21.5~30.0MHz
Q12	VCO	50.0~54.0MHz. TS-680S only
Q13,14	VCO output buffer	
Q15	VCO output amplifier	
Q16,17	Switching	Reduces noise when RF AMP and ATT are turned ON/OFF.
Q18,19	RX 1st mixer	Receiving frequency→40.055MHz.
Q20	13.8V line switching	Turned ON in RX mode.
Q21	Post amplifier	40.055MHz.
Q22,23	RX 2nd mixer	40.055MHz→455kHz.
Q27	IF amplifier	455kHz.
Q28,29	Switching	Shunt IF circuit when NB pulse is generated.
Q30,31	IF amplifier	455kHz.
Q32,34	8V line switching	Turned ON in CW mode (excluding CWN).
Q35~39	8V line switching	Q35: SSB Q36: AM Q37: FM Q38: CW Q39: CWN
Q40,41	Switching	Shunt of TX circuit in RX mode.
Q42	Switching	Shunt of RX circuit in TX mode.
Q43	8V line switching	Generates RB.
Q44	8V line switching	Generates AMT and SST.
Q45~47	NB amplifier	455kHz.
Q48	NB buffer	
Q49	NB AGC amplifier	
Q50	Switching	Set to "L" when NB pulse is generated in NB2.
Q51	Switching	Set to "L" when NB pulse is generated in NB1.
Q52	Switching	Set to "L" when SKB pulse is generated.
Q53	IF buffer	AGC, AM.
Q54	AF buffer	AM.
Q55	Switching	Set to "L" in TX mode.
Q56	AF amplifier	
Q57	Switching	Set to "L" in MUT and TX mode.
Q58	AF amplifier	FM.
Q59	AGC amplifier	
Q60	Generation of S-meter voltage.	
Q61	S-meter amplifier	
Q62	Switching	Prevents S-meter from over-reading when power is turned ON.
Q63	Switching	Generates HF voltage. TS-680S only
Q64	Switching	Generates 50MHz band voltage. TS-680S only
Q65,66	Switching	Sets AGC time constant in mode other than FM mode.
Q67	Switching	Invalidates changeover of FAST/SLOW of AGC in FM mode.
Q68	Generation of ALC meter voltage	
Q69	ALC meter amplifier	
Q70	RF amplifier	28MHz band. TS-680S only
Q71	Buffer	28MHz band. TS-680S only
Q72	RF amplifier	50MHz band. TS-680S only
Q73	Buffer	50MHz band. TS-680S only

DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
Q74	TX AF amplifier	
Q75	Switching	Shunt of FMM in RX mode.
Q76	8V line switching	Turned ON in TOC (Tone transmission) mode.
Q77	Switching	Generates RXB. Set to "L" in TX mode.
Q78	HET amplifier	39.6MHz.
Q79,80	TX 2nd mixer	40.055MHz (39.6MHz in FM mode)→Transmission frequency.
Q81	RF amplifier	
Q82	8V line switching	Turned ON in FM/TX mode.
Q83,85	13.8V line switching	Turned ON in 50MHz band. TS-680S only
Q84	Switching	Connects KEY line in CW mode.
Q86	TX IF amplifier	455kHz.
Q87	8V line switching	Turned ON in TX mode. Generates KEYING timing.
Q88	8V line switching	Turned ON in FM, CW and TX mode.
Q89	AF amplifier	Output to RX packet terminal.
Q90,91	Switching	Generates SS and CSS.
Q92	Switching	Set to "L" in power-down mode.
Q93	Switching	Set to "L" in mode other than power-down mode.
Q94	Switching	Set to "L" in HF mode. TS-680S only
Q95	Switching	Set to "L" in 50MHz mode. TS-680S only
Q96	Switching	Set to "L" in SSB and FM mode.
Q97	Switching	Generates squelch signal for packet.
Q98	Switching	Generates NFT.
Q99	Switching	Connects SEM line in CW mode.
D1~3	Switching	Changeover of BPF.
D5,6,9,10	Protection from lightning surge.	
D7,8,11~20	Switching	Changeover of BPF.
D21,22	Switching	Changeover of BPF. TS-680S only
D23	Absorption of surge voltage of relay	For attenuator relay.
D24	Prevention of reverse current	Information on 28F 28MHz band and 50F 50MHz band. TS-680S only
D25	Absorption of surge voltage of relay	For RF AMP changeover relay. TS-680S only
D26~29	Prevention of reverse current	Decodes band information.
D30	Voltage shift	
D31	Prevention of reverse current	Decodes band information. TS-680S only
D33	Prevention of reverse current	
D34,35	Change of VCO frequency	0.5~10.5MHz.
D36,37	Change of VCO frequency	10.5~21.5MHz.
D38	VCO switching	For 10.5~21.5MHz.
D39,40	Change of VCO frequency	21.5~30.0MHz.
D41	VCO switching	For 21.5~30.0MHz.
D42,43	Change of VCO frequency	50.0~54.0MHz. TS-680S only
D44	VCO switching	For 50.0~54.0MHz. TS-680S only
D45	Switching	For TX mixer of VCO output.
D46	Switching	For RX mixer of VCO output.
D47	Attenuator	For CAR level.
D48	Prevention of reverse current	RXB+SSB.
D49	Prevention of reverse current	
D50,53	Switching	Receiving 1st IF MCF circuit.
D51,52	Switching	Transmission 2nd IF MCF circuit.
D54	Switching	Receiving 2nd IF circuit.
D55	Switching	Transmission 1st IF circuit.
D56,57,60~63	Switching	Selects 455kHz filter.
D58,59	Prevention of reverse current	SSB+CW wide.
D64	Switching	Transmission 1st IF circuit.

DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
D65	Switching	Receiving 2nd IF circuit.
D66	Switching	RB line.
D67	Switching	SS line.
D68	Prevention of reverse current	SSB+AMB.
D69	Prevention of reverse current	SSB+CWB.
D70	Prevention of reverse current	MUT+RB.
D71	Noise detection	FM squelch circuit.
D72	Switching	FM 2nd IF circuit.
D73,74	AGC detection	
D75	AM detection	
D76	Prevention of reverse current	TXB.
D77	Prevention of reverse current	FMB+CWB.
D78	Temperature compensation	S-meter circuit.
D79	Prevention of reverse current	50W+PPD.
D80	Prevention of reverse current	PD+FMB.
D81	Prevention of reverse current	AMB+CWB.
D82	Prevention of reverse current	VSF.
D83	Prevention of reverse current	ALC.
D85	Prevention of reverse current	Protection.
D86	Noise detection	NB1.
D87	Noise detection	NB2.
D88	Voltage shift	SBK.
D89	Prevention of reverse current	CWB+FMB.
D90	Absorption of surge voltage of relay	For remote control relay.
D91,92	Voltage shift	Outside ALC.
D93	Voltage shift	For DELAY TIME module VCC.
D95	Prevention of reverse current	
D96	Switching	HET amplifier input.
D97,98	Prevention of reverse current	RXB+NFT+ALC.
D99	Switching	Receiving HET output.
D100	Switching	Transmission HET output.
D101,102	Switching	FM transmission IF output.
D103~106	Switching	Changeover of transmission BPF.
D107	Prevention of reverse current	RXB+NFT.
D108	Prevention of reverse current	CWB.
D109,110	Switching	CAR TIF input circuit.
D111	Temperature compensation	TIF amplifier.
D112	Prevention of reverse current	RB.
D113	Prevention of reverse current	Power supply circuit for keying.
D114	Prevention of reverse current	KEY.
D115	Prevention of reverse current	PC1.
D116	Stabilization of voltage	For ALC amplifier.
D117	Prevention of reverse current	Unbalancing circuit of AM carrier.
D118	VCO switching	For 0.5~105MHz.
D119	Prevention of reverse current	SSB+FMB.
D120	Prevention of reverse current	For IC8 VCC.
D122	Switching	CAR TIF input circuit.
D123	Prevention of reverse current	CWB.
D124	Switching	FM transmission IF output.
D125	Voltage shift	Protection circuit.
D126	Switching	Transmission output in mode other than FM mode.
D501	Isolator	CWB.
D502	Isolator	VOX line.
D503	Voltage shift	VOX line.

DESCRIPTION OF COMPONENTS

SIDE TONE UNIT (X59-1060-00)

Component	Use/Function	Operation/Condition/Compatibility
Q1	SIDE TONE oscillation	800Hz.
D1	Switching	Turned ON when KEY DOWN.
D2	Prevention of reverse current	
D3	Temperature compensation	

VOX UNIT (X59-1080-00)

Component	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Comparison of VOX level	
IC1 (2/2)	Comparison of ANTI VOX level	
IC2	NOR circuit (RS flip-flop)	
Q1	Switching transistor	Q1 is ON when IC2/11pin is "H"
D1,2	Prevention of reverse current	

FM MIC AMP UNIT (X59-3000-02)

Component	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Low-pass filter	1,2: Output
IC1 (2/2)	Limiting amplifier	6: Input 7: Output
Q1	SUB TONE	

TRX UNIT (X59-3340-00)

Component	Use/Function	Operation/Condition/Compatibility
Q1~5	Switching transistor	Q3,5 are ON in receiving mode, and Q1,2,4 are ON in transmission mode.
D1,2	Switching	

NB2 UNIT (X59-3350-00)

Component	Use/Function	Operation/Condition/Compatibility
IC1	One-shot multi vibrator	Synchronized to pulse, with width of 1/4,4/4: 5mS and 2/4,3/4: 40mS.
Q1	Switching transistor	Turned ON when pulse is 15mS.
Q2	Switching transistor	Turned OFF when pulse is 40mS.

DELAY TIME UNIT (X59-3360-00)

Component	Use/Function	Operation/Condition/Compatibility
IC1	One-shot multi vibrator	
Q1,2,6	Switching transistor	Turned ON when CW KEY DOWN.
Q3~5,7	Switching transistor	Turned OFF when CW KEY DOWN.
D1	Prevention of reverse current	

FAN UNIT (X59-3370-00)

Component	Use/Function	Operation/Condition/Compatibility
IC1	Temperature detection	1/2: Power down 2/2: Fan motor operation
Q1	Switching transistor	

PARTS LIST

CAPACITORS

CC 45 TH 1H 220 J
1 2 3 4 5 6

- 1 = Type ceramic, electrolytic, etc.
2 = Shape round, square, etc.
3 = Temp. coefficient
4 = Voltage rating
5 = Value
6 = Tolerance

• Temperature Coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	-220	-330	-470	-750

• Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+ 40 - 20	+ 80 - 20	+ 100 - 0	10μF-10~+50 4.7μF-10~+75

Less than 10 pF

• Rating voltage

2nd word 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	—
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	—
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	—

• Chip capacitors

(EX) CC 73 F SL 1H 000 J
1 2 3 4 5 6 7
(Chip) (CH,RH,UJ,SL)
(EX) CK 73 F F 1H 000 Z
1 2 3 4 5 6 7
(Chip) (B,F)

→ Refer to the table above.

RESISTORS

• Chip resistor (Carbon)

(EX) RD 73 E B 28 000 J
1 2 3 4 5 6 7
(Chip) (B,F)

• Carbon resistor (Normal type)

RD 14 B B 28 000 J
1 2 3 4 5 6 7



• Capacitor value

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF

1 0 3 = 0.01μF

2 2 0 = 22pF
1st number | Multiplier
2nd number

Example CC45TH = -470±60 ppm/°C

Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Dimension

Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1/ 10W	2E	1/ 4W	3A	1W
2B	1/ 8W	2H	1/ 2W	3D	2W
2C	1/ 6W				

Dimension



PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
TS-140S/680S						
1	1B	*	A01-1032-02	CASE (UPPER)		
2	3B	*	A01-1033-02	CASE (LOWER)		
3	2F	*	A10-1286-01	CHASSIS		
4	3C	*	A11-0404-01	SUB CHASSIS		
5	2G	*	A20-2622-03	PANEL ASSY		R
5	2G	*	A20-2638-03	PANEL ASSY		A
6	1H	*	A22-0753-02	SUB PANEL		
7	2F	*	A23-1498-13	REAR PANEL		
8	1H	*	A33-0408-04	REFLECTOR		
13	2H	*	B01-0660-03	PANEL ESCUTCHEON ASSY		
14	2G	*	B10-1101-03	FRONT GLASS		B
14	2G	*	B10-1102-03	FRONT GLASS		A
15	2H	*	B11-0447-04	OPTICAL FIBER ASSY		
17	2H	*	B11-0450-04	FILTER		
18	1J		B30-0817-15	PILOT LAMP (14V, 80MA)		
19	1H	*	B31-0661-05	METER		
22	1K	*	B46-0410-20	WARRANTY CARD	K	
23	1K	*	B50-8199-20	INSTRUCTION MANUAL		
-		*	B01-0659-03	ESCUTCHEON		
-		*	B40-3782-04	MODEL NAME PLATE	MTW	
-		*	B40-3799-04	MODEL NAME PLATE		B
-		*	B40-3839-04	MODEL NAME PLATE	K	
01			CK45F1H103Z	CERAMIC 0.010UF Z		
30	2D		E04-0167-05	RF COAXIAL CABLE RECEPTACLE		
31	1J		E07-0751-05	7P DIN PLUG (ACSY)		
32	1J		E30-2065-05	DC POWER CORD ASSY (ACSY)		
33	1J		E31-2154-05	CONNECTING WIRE (CAL) ACSY		
34	1J		E07-1351-05	13P PLUG (ACSY)		
-			E07-0852-15	8P METAL PLUG (MIC)	KM	
-		*	E31-3297-05	FLEXIBLE CABLE		
-		*	E31-3298-05	FLEXIBLE CABLE		
-		*	E31-3299-05	FLEXIBLE CABLE		
-		*	E31-3300-05	FLEXIBLE CABLE		
38	1J		F05-2036-05	FUSE (20A)		
40	1C	*	F11-1069-02	SHIELDING COVER		
41	1F	*	F11-1088-04	SHIELDING COVER (SIGNAL UNIT)		
-		*	F11-0818-24	SHIELDING COVER		
-		*	F19-0657-04	BLIND PLATE (REAR PANEL)		B
-			F20-0521-04	INSULATING SHEET (LITHIUM BATT)		
47	2G		G02-0505-05	KNOB FIXED SPRING		
48	1C, 11	*	G02-0578-04	LEAF SPRING		
49	3C		G10-0610-04	FELT		
50	1A, 2H	*	G10-0656-04	FELT (SP)		
51	2H	*	G10-0660-04	FELT (PANEL)		
52	2E	*	G10-0668-04	FELT (SIGNAL UNIT)		
53	2E		G10-0633-04	FELT (CHASSIS SIDE)		
54	1A		G13-0684-04	CUSHION (SUB CHASSIS)		
55	2G		G13-0831-04	CUSHION (SIGNAL UNIT)		
56	2G	*	G13-0848-04	CUSHION (KNOB)		
57	2G, 2H	*	G13-0849-04	CUSHION (KNOB)		
58	2H	*	G13-0850-04	CUSHION (KNOB)		

E: Scandinavia & Europe K: USA

P: Canada

U: PX (Far East, Hawaii)

T: England

M: Other Areas

UE: AAFES (Europe)

X: Australia

A : TS-140S (K, M, T, W)

B : TS-680S (K)

△ indicates safety critical components.

PARTS LIST

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
59	2H	*	G13-0863-04	CUSHION (ESCUTCHEON)		
60	1I	*	G13-0864-04	CUSHION (REFLECTOR)		
62	1A, 1B		G53-0509-04	PACKING (CASE SIDE)		
-			G02-0565-04	FLAT SPRING		
-			G11-0609-04	CUSHION (MIC)	KM	
-			G13-0656-04	CUSHION (FLEXIBLE CABLE)		
-			G13-0855-04	CUSHION (MIC)		
-		*	G13-0885-04	CUSHION (FLEXIBLE CABLE)	W	
-		*	G13-0891-04	CUSHION		
66	3K	*	H01-8146-04	CARTON BOX		A
66	3K	*	H01-8165-04	CARTON BOX		B
68	2J	*	H10-2633-02	PACKING FIXTURE (FRONT)		
69	2K	*	H10-2634-02	PACKING FIXTURE (REAR)		
70	2J		H12-1315-04	CUSHION		
71	2J	*	H12-1405-04	CUSHION (FRONT)		
72	2K		H20-1410-03	PROTECTIVE COVER		
73	1J		H25-0112-04	PROTECTIVE BAG (DC CORD)		
74	1J		H25-0079-04	PROTECTIVE BAG (MIC)	KM	
77	3B		J02-0323-05	FOOT (REAR)		
78	3A		J02-0440-04	ASSISTANT FOOT		
79	1A, 3A		J02-0441-05	FOOT (SMALL TYPE)		
80	3A, 3B		J02-0442-04	FOOT (FOOT)		
82	1I, 2I		J21-2664-14	MOUNTING HARDWARE (SW)		
83	3A		J21-4208-04	MOUNTING HARDWARE (ASSIST FOOT)		
84	1H		J31-0141-04	SPACER RING (MIC)		
85	1H		J32-0792-04	HEX BOSS		
86	2F		J42-0442-05	HOLE BUSHING		
87	2A	*	J50-0401-05	HINGE		
88	3C	*	J50-0402-05	HINGE		
-			J13-0404-05	FUSE HOLDER (DC POWER CARD ASSY)		
-			J61-0307-05	WIRE BAND		
92	1B		K01-0407-05	CARRING HANDLE		
93	2G		K21-0778-02	MAIN KNOB		
94	2G		K23-0710-04	KNOB (INSIDE)		
95	2G		K29-0741-34	KNOB (OUTSIDE)		
96	1H		K29-0758-14	PUSH KNOB (POWER SW)		
97	2G	*	K29-3078-04	KNOB (CW SW)		
98	2G	*	K29-3079-04	KNOB (PWR, MIC, RFGIN, NB LEVEL)		
99	2G	*	K29-3080-14	KNOB (M, CH)		
100	2G	*	K29-3081-04	KNOB (A/B)		
101	2G	*	K29-3082-04	KNOB (SPLIT)		
102	2G	*	K29-3083-04	KNOB (A=B)		
103	2G	*	K29-3084-04	KNOB (LSB/USB)		
104	2G	*	K29-3085-04	KNOB (CW/N)		
105	2G	*	K29-3086-04	KNOB (AM/FM)		
106	2G	*	K29-3087-04	KNOB (CLEAR)		
107	2G	*	K29-3088-04	KNOB (SCAN)		
108	2G	*	K29-3089-04	KNOB (VFO/M)		
109	2G	*	K29-3090-04	KNOB (F. LOCK)		
110	2G	*	K29-3091-04	KNOB (M-V)		
111	2G	*	K29-3092-04	KNOB (M. IN)		
112	2G	*	K29-3093-04	KNOB (BAND)		
113	2H	*	K29-3094-04	KNOB (NB ETC)		


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120	3C		N15-1040-46	FLAT WASHER		
121	2G		N19-0637-04	FLAT WASHER (MAIN KNOB)		
A	2H		N09-0256-05	GND SCREW (SUB PANEL)		
B	3D		N09-0372-04	SCREW (PULLEY)		
C	1F		N88-2608-46	FLAT HEAD TAPTITE SCREW		
D	2G, 2H		N09-0644-14	BIND SCREW (FRONT GLASS)		
E	2F		N30-2606-41	PAN HEAD MACHINE SCREW		
F	3C		N30-4014-41	PAN HEAD MACHINE SCREW (GND)		
G	2G, 1I		N32-2606-46	FLAT HEAD MACHINE SCREW		
H	2A		N32-3006-46	FLAT HEAD MACHINE SCREW		
I	3C		N09-0623-04	SEMUS SCREW (50MHZ MODULE)		B
J	1A, 1B		N33-3006-41	OVAL HEAD MACHINE SCREW(CASE)		
K	3E, 2C		N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
L	2F		N87-3006-41	BRAZIER HEAD TAPTITE SCREW		
M	2A, 1C		N87-3006-46	BRAZIER HEAD TAPTITE SCREW		
N	3A		N87-3008-41	BRAZIER HEAD TAPTITE SCREW		
O	2A		N88-3006-46	FLAT HEAD TAPTITE SCREW		
P	2D		N87-3010-41	BRAZIER HEAD TAPTITE SCREW(ANT		
R	2G		N90-2606-46	TP HEAD MACHINE SCREW		
R1			RS14AB3A560J	FL-PROOF RS 56 J 1W		
129	1H		S40-2437-15	PUSH SWITCH (POWER)		
-			S50-1406-05	SENSITIVE SWITCH(MICROPHONE)	KM	
133	3C	*	T07-0252-05	SPEAKER		
134	1J	*	T91-0352-15	MICROPHONE	KM	
137	1I	*	W02-0802-05	ENCODER ASSU		
138	3F	*	W09-0515-05	LITHIUM BATTERY		
142	1I, 1H	*	X41-3030-00	SWITCH UNIT		B
142	1I, 1H	*	X41-3030-11	SWITCH UNIT		A
144	1C	*	X45-3100-00	FINAL UNIT		B
144	1C	*	X45-3100-11	FINAL UNIT		A
145	2C, 1F	*	X51-3040-00	FILTER UNIT		B
145	2C, 1F	*	X51-3040-11	FILTER UNIT		A
146	3F	*	X53-3100-11	CONTROL UNIT		A
146	3F	*	X53-3100-12	CONTROL UNIT		B
147	1I	*	X54-3050-00	DISPLAY UNIT	KMT	
147	1I	*	X54-3050-61	DISPLAY UNIT	W	
148	2E	*	X57-3190-00	SIGNAL UNIT		B
148	2E	*	X57-3200-10	SIGNAL UNIT	KMT	
148	2E	*	X57-3200-61	SIGNAL UNIT	W	
SWITCH UNIT (X41-3030-XX) -00 : TS-680S -11 : TS-140S						
C1, 2			CK41FY1E102M	CYLND CHIP C 1000PF M		
C3			CC41FSL1H101J	CYLND CHIP C 100PF J		
C4			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C5, 6			CC41FSL1H101J	CYLND CHIP C 100PF J		
C7			CK41FY1E222M	CYLND CHIP C 2200PF M		
C8			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C9			CE04EW1A470M	ELECTR0 47UF 10WV		
C10, 11			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C12			CE04EW1H100M	ELECTR0 10UF 50WV		
C13			CE04EW1A470M	ELECTR0 47UF 10WV		
C14			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C15			CC41FSL1H101J	CYLND CHIP C 100PF J		A

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C16 ,17 C18 C19			CE04EW1H010M CE04EW1H100M CE04EW1A470M	ELECTR0 1.0UF 50WV ELECTR0 10UF 50WV ELECTR0 47UF 10WV		A A A
CN1 CN2 CN3 CN4 CN5			E40-3241-05 E40-3237-05 E40-3239-05 E40-3237-05 E40-3239-05	PIN CONNECTOR (6P) PIN CONNECTOR (2P) PIN CONNECTOR (4P) PIN CONNECTOR (2P) PIN CONNECTOR (4P)		A
CN6 CN7 CN8 J1	1H	* *	E31-3307-05 E31-3306-05 E40-3247-05 E11-0413-05	CONNECTING WIRE(AF,SO) CONNECTING WIRE(RIT,IF SHIFT) PIN CONNECTOR (3P) PHONE JACK		
R1 -3 R4 R5 R6 R7			RD41FB2B103J RD41FB2B102J RD41FB2B821J RD41FB2B101J RD41FB2B223J	CYLND CHIP R 10K J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 820 J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 22K J 1/8W		
R8 ,9 R10 R11 R12 ,13 R14			RD41FB2B101J RD41FB2B822J RD41FB2B823J RD41FB2B472J RD41FB2B332J	CYLND CHIP R 100 J 1/8W CYLND CHIP R 8.2K J 1/8W CYLND CHIP R 82K J 1/8W CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 3.3K J 1/8W		
R15 R16 R17 R18 R19			RD41FB2B101J RD41FB2B221J RD41FB2B102J RD41FB2B101J RD41FB2B562J	CYLND CHIP R 100 J 1/8W CYLND CHIP R 220 J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 5.6K J 1/8W		A A
R20 R21 R22 R23 VR1			RD41FB2B104J RD41FB2B103J RD41FB2B223J RD41FB2B102J R12-3127-05	CYLND CHIP R 100K J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 22K J 1/8W CYLND CHIP R 1.0K J 1/8W TRIMMING PNT. (10K)		A A A A
VR2 VR3 W1 -11	2I 1I	* *	R19-9411-05 R19-3424-05 R92-0670-05	POTENTIOMETER (AF,SQL) POTENTIOMETER (RIT,IF SHIFT) CHIP R 0 0HM		
D1 D2 ,3 IC1 Q1 -3 Q4			1N60 RLS73 UPC1158H2 DTC114EK 2SA1162(Y)	DIODE CHIP DIODE IC(ALC AMP) DIGITAL TRANSISTOR TRANSISTOR		
Q5 ,6 Q6			2SC2712(Y) 2SC2712(Y)	TRANSISTOR CHIP TRANSISTOR		A
FINAL UNIT (X45-3100-XX) -00 : TS-680S -11 : TS-140S						
C1 C9 C10 ,11 C12 C13			CK45B1H561K CM93D2H681J C91-1004-05 CC45SL2H151J CM73F2H122J	CERAMIC 560PF K MICA 680PF J CERAMIC 0.0068UF J CERAMIC 150PF J CHIP C 1200PF J		
C15 C16 C18 C21 C22			C91-0119-05 CE04EW1H100M CE04EW1E101M C91-0119-05 CE04EW1H100M	CERAMIC 0.047UF K ELECTR0 10UF 50WV ELECTR0 100UF 25WV CERAMIC 0.047UF K ELECTR0 10UF 50WV		

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C24			CE04EW1E101M	ELECTR0 100UF 25WV		
C28			CE04EW1E470M	ELECTR0 47UF 25WV		
C32 ,33			C90-0817-05	ELECTR0 1000UF 16WV		
C36			CE04EW1E470M	ELECTR0 47UF 25WV		
C37			C91-0119-05	CERAMIC 0.047UF K		
C38			CE04EW1E470M	ELECTR0 47UF 25WV		
C40 ,41			CE04EW1E470M	ELECTR0 47UF 25WV		
C42			C91-0119-05	CERAMIC 0.047UF K		
C43			CC45SL2H121J	CERAMIC 120PF J		
-			E31-2067-05	COAXIAL CABLE WITH PLUG(SDD)		B
-			E31-3028-05	COAXIAL CABLE WITH PLUG (PN)		
-			E31-3304-05	COAXIAL CABLE WITH PLUG (DRV)		
-		*	E31-3322-05	CONNECTING WIRE		
-		*	E31-3324-05	CONNECTING WIRE(FAN)		
-		*	E31-3327-05	CONNECTING WIRE		
CN1			E40-3238-05	PIN CONNECTOR (3P)		
CN2			E40-3239-05	PIN CONNECTOR (4P)		
CN3			E40-3238-05	PIN CONNECTOR (3P)		
CN4		*	E31-3317-05	CONNECTING WIRE		B
CN5			E40-3237-05	PIN CONNECTOR (2P)		
I58	1C		F29-0014-05	INSULATOR		
I72	2D	*	F01-0954-01	HEAT SINK		
I76	1C	*	F09-0417-05	FAN (MOTOR)		
-		*	F20-0078-05	INSULATING BOARD		
-		*	F20-0582-04	INSULATING BOARD		
I78	2D	*	G02-0574-04	LEAF SPRING		
-			G02-0571-04	FLAT SPRING (02)		
-			L92-0102-05	TROIDAL CORE (KT-41)		
-			L92-0106-05	TROIDAL CORE (KT-41)		
L1			L40-1501-14	SMALL FIXED INDUCTOR		
L2			L40-3391-14	SMALL FIXED INDUCTOR		
L3			L19-0315-25	TROIDAL COIL		
L4 ,5		*	L33-0699-05	CH0KE COIL		
L6 ,7			L33-0232-05	CH0KE COIL (1UH)		
L8		*	L33-0699-05	CH0KE COIL		
L9			L19-0342-05	DRIVE TRANSFORMER		
L10 ,11			L33-0617-05	TROIDAL COIL		
L12			L39-0424-05	NFB COIL		
L13		*	L39-0431-05	TROIDAL COIL		
L14			L33-0651-05	CH0KE COIL		
L15			L33-0617-05	TROIDAL COIL		
L16			L40-1011-14	SMALL FIXED INDUCTOR		
L17			L15-0016-05	LOW-FREQUENCY CH0KE COIL		
Q	1C,1D		N87-3008-46	BRAZIER HEAD TAPTITE SCREW		
S	1C		N09-0623-04	SEMS SCREW		
T	2C		N35-3006-46	BINDING HEAD MACHINE SCREW		
R5			RC05GF2H3R9J	RC 3.9 J 1/2W		
R8 ,9			RS14DB3A181J	FL-PROOF RS 180 J 1W		
R10 -13			RS14DB3A5R6J	FL-PROOF RS 5.6 J 1W		
R14 ,15			RS14DB3A150J	FL-PROOF RS 15 J 1W		
R16 ,17			RS14DB3A3R3J	FL-PROOF RS 3.3 J 1W		
R18			RS14DB3A100J	FL-PROOF RS 10 J 1W		

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VR1 ,2 W1 W2 ,3			R12-1431-05 R92-0150-05 R92-1061-05	TRIMMING PNT. (1K) JUMPER RES 0 0HM JUMPER RES 0 0HM		A
K1			S51-2417-05	RELAY		B
D1 D2 ,3 D4 D5 D6			MV-5T SV-03YS 1S1555 1S1555 SG-5L(R)	VARISTER VARISTER DIODE DIODE DIODE		R
D7 Q1 Q2 ,3 Q4 ,5 Q6 ,7			MTZ8.2JA 2SC1971 2SC2509 2SC2879 2SD1406(Y)	ZENER DIODE TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR		
Q8 ,9 TH1			AN7805 5TP41L	IC(VOLTAGE REGULATOR/ +5V) THERMISTOR		
192	1D	*	X59-3370-00	MODULE UNIT		
FILTER UNIT (X51-3040-XX) -00 : TS-680S -11 : TS-140S						
C1 C2 C3 C4 C5			CM93D2H152J CM93D2H471J CM93D2H152J CM93D2H221J CM93D2H821J	MICA 1500PF J MICA 470PF J MICA 1500PF J MICA 220PF J MICA 820PF J		
C6 C7 C8 ,9 C10 C11			CC45SL2H431J CC45SL2H241J CC45SL2H431J CC45SL2H151J CC45SL2H331J	CERAMIC 430PF J CERAMIC 240PF J CERAMIC 430PF J CERAMIC 150PF J CERAMIC 330PF J		
C12 C13 C14 C15 C16			CC45SL2H820J CC45SL2H331J CC45SL2H101J CC45SL2H431J CC45SL2H331J	CERAMIC 82PF J CERAMIC 330PF J CERAMIC 100PF J CERAMIC 430PF J CERAMIC 330PF J		
C17 C18 C19 ,20 C21 C22			CC45SL2H151J CC45SL2H330J CC45SL2H151J CC45SL2H121J CC45SL2H181J	CERAMIC 150PF J CERAMIC 33PF J CERAMIC 150PF J CERAMIC 120PF J CERAMIC 180PF J		
C23 C24 C25 C26 C27			CC45SL2H820J CC45SL2H680J CC45SL2H181J CC45SL2H121J CC45SL2H101J	CERAMIC 82PF J CERAMIC 68PF J CERAMIC 180PF J CERAMIC 120PF J CERAMIC 100PF J		
C28 C29 C30 C31 C32			CC45SL2H470J CC45SL2H680J CC45SL2H330J CC45SL2H820J CC45SL2H680J	CERAMIC 47PF J CERAMIC 68PF J CERAMIC 33PF J CERAMIC 82PF J CERAMIC 68PF J		
C33 C34 C35 ,36 C37 C38			CC45SL2H100D CC45SL2H820J CC45SL2H330J CC45SL2H270J CC45SL2H120J	CERAMIC 10PF D CERAMIC 82PF J CERAMIC 33PF J CERAMIC 27PF J CERAMIC 12PF J		B B

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C39			CC45SL2H270J	CERAMIC 27PF J		B
C40 .41			CC45SL2H330J	CERAMIC 33PF J		
C42 .43			CC45SL2H560J	CERAMIC 56PF J		B
C66			CC45CH2H030C	CERAMIC 3.0PF C		
C67			CC45CH1H560J	CERAMIC 56PF J		
C68			CC45CH1H101J	CERAMIC 100PF J		
C79			CC45CH1H680J	CERAMIC 68PF J		B
C80			CK45B1H472K	CERAMIC 4700PF K		B
C81 .82			CE04EW1E470M	ELECTR0 47UF 25WV		B
C83			CE04EW1H3R3M	ELECTR0 3.3UF 50WV		B
C84 .85			CK45B1H472K	CERAMIC 4700PF K		B
C101			C05-0309-05	TRIMMING CAP (40P)		B
C102			C05-0030-15	TRIMMING CAP (20P)		
CN1			E40-3238-05	PIN CONNECTOR (3P)		
CN2			E40-3238-05	PIN CONNECTOR (3P)		B
CN3			E40-3242-05	PIN CONNECTOR (7P)		
CN4			E40-3239-05	PIN CONNECTOR (4P)		
CN5			E04-0157-05	PIN CONNECTOR		
CN6			E04-0157-05	PIN CONNECTOR		B
CN7			E40-5059-05	PIN CONNECTOR (5P)		
CN8 .9		*	E31-3330-15	CONNECTING WIRE		
CN10			E40-5059-05	PIN CONNECTOR (5P)		
196	1F		J32-0761-04	BOSS		
-			L92-0102-05	TR0IDAL C0IL (KT-41)		
-			L92-0107-05	TR0IDAL C0IL (T50-2)		
-			L92-0108-05	TR0IDAL C0IL (T50-6)		
L1			L34-3148-05	TR0IDAL C0IL		
L2			L34-3147-05	TR0IDAL C0IL		
L3			L34-3150-05	TR0IDAL C0IL		
L4			L34-3149-05	TR0IDAL C0IL		
L5			L34-3152-05	TR0IDAL C0IL		
L6			L34-3151-05	TR0IDAL C0IL		
L7			L34-3153-05	TR0IDAL C0IL		
L8			L34-3154-05	TR0IDAL C0IL		
L9 .10			L34-3156-05	C0IL		
L11			L34-3157-05	C0IL		
L12			L34-3158-05	C0IL		
L13 .15			L34-1021-05	C0IL		B
L16			L33-0222-05	C0IL		B
L17			L34-1022-05	C0IL		B
L18			L34-1027-05	C0IL		B
L19			L39-0406-05	TR0IDAL C0IL		
L20			L33-0651-05	CH0KE C0IL		B
L21 .22			L40-1011-14	SMALL FIXED INDUCTOR		
L22			L40-1011-14	SMALL FIXED INDUCTOR		B
L23 .24			L40-1021-14	SMALL FIXED INDUCTOR		
L25 .30			L40-1011-14	SMALL FIXED INDUCTOR		
L31			L40-1011-14	SMALL FIXED INDUCTOR		B
L32			L40-6825-04	SMALL FIXED INDUCTOR		
U	1F		N30-3006-46	PAN HEAD MACHINE SCREW		
VR1			R12-0431-05	TRIMMING P0T. (100)		
W17 .19			R92-0150-05	JUMPER REST 0 0HM		

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W20			R92-0150-05	JUMPER REST 0 NHM		A
K1 -12			S51-1432-05	RELAY		B
K13 -15			S51-1432-05	RELAY		
K16			S51-1429-05	RELAY		
D1 -6			1S1555	DIODE		B
D7			1S1555	DIODE		
D8			1S1555	DIODE		
D9 -10			1SS101	DIODE		
D11			DSP-301N	SURGE ABSORBER		
Q1			2SC2538-22-A	TRANSISTOR		B
Q2			M57735	IC (POWER MODULE)		B
Q3			2SC2459 (BL)	TRANSISTOR		
CONTROL UNIT (X53-3100-XX) -11 : TS-140S -12 : TS-680S						
C2			CE04EW1C470M	ELECTRO 47UF 16WV		
C3 -4			CK41FY1E102M	CYLND CHIP C 1000PF M		
C5			C092M1H473K	MYLAR 0.047UF K		
C6			C092M1H223K	MYLAR 0.022UF K		
C7			CK41FY1E222M	CYLND CHIP C 2200PF M		
C9			CE04EW1C470M	ELECTRO 47UF 16WV		
C10			CC41FUJ1H220J	CYLND CHIP C 22PF J		
C11			CC41FCH1H100D	CYLND CHIP C 10PF D		
C13			CC41FCH1H150J	CYLND CHIP C 15PF J		
C14			CC41FCH1H120J	CYLND CHIP C 12PF J		
C15			CC41FCH1H050C	CYLND CHIP C 5.0PF C		
C16			CK41FY1E102M	CYLND CHIP C 1000PF M		
C17			CE04EW1C470M	ELECTRO 47UF 16WV		
C18 -19			CK41FY1E102M	CYLND CHIP C 1000PF M		
C21			CK41FY1E102M	CYLND CHIP C 1000PF M		
C23			CE04EW1C220M	ELECTRO 22UF 16WV		
C25			CK41FB1H391K	CYLND CHIP C 390PF K		
C26			CK41FW1H821M	CYLND CHIP C 820PF M		
C27			CK41FB1H391K	CYLND CHIP C 390PF K		
C30			CE04EW1C220M	ELECTRO 22UF 16WV		
C33			CC41FSL1H330J	CYLND CHIP C 33PF J		
C34			CC41FSL1H680J	CYLND CHIP C 68PF J		
C35			CC41FSL1H330J	CYLND CHIP C 33PF J		
C38			CE04EW1C470M	ELECTRO 47UF 16WV		
C40			CK41FY1E102M	CYLND CHIP C 1000PF M		
C41			C092M1H223K	MYLAR 0.022UF K		
C42			C092M1H103K	MYLAR 0.010UF K		
C43			CK41FY1E222M	CYLND CHIP C 2200PF M		
C45			CE04EW1C470M	ELECTRO 47UF 16WV		
C46			CC41FCH1H100D	CYLND CHIP C 10PF D		
C48			CC41FCH1H220J	CYLND CHIP C 22PF J		
C49			CC73FCH1H270J	CHIP C 27PF J		
C50			CC41FCH1H050C	CYLND CHIP C 5.0PF C		
C52			CE04EW1C470M	ELECTRO 47UF 16WV		
C58			CC41FSL1H270J	CYLND CHIP C 27PF J		
C59			CC41FSL1H560J	CYLND CHIP C 56PF J		
C60			CC41FSL1H270J	CYLND CHIP C 27PF J		
C72			CK41FA1H181K	CYLND CHIP C 180PF K		
C73			CK41FB1H391K	CYLND CHIP C 390PF K		
C74			CK41FA1H181K	CYLND CHIP C 180PF K		

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C77			CC41FCH1H030C	CYLND CHIP C 3.0PF	C	
C78			CC73FCH1H560J	CHIP C 56PF	J	
C79			CC41FUJ1H180J	CYLND CHIP C 18PF	J	
C80			CC41FCH1H020C	CYLND CHIP C 2.0PF	C	
C82			CE04EW1C220M	ELECTRN 22UF	16WV	
C87, 88			CC41FSL1H560J	CYLND CHIP C 56PF	J	
C90			CC41FSL1H330J	CYLND CHIP C 33PF	J	
C91			CC41FSL1H560J	CYLND CHIP C 56PF	J	
C92			CC41FSL1H330J	CYLND CHIP C 33PF	J	
C99			CC41FCH1H020C	CYLND CHIP C 2.0PF	C	
C101			CC41FCH1H030C	CYLND CHIP C 3.0PF	C	
C102			CC41FCH1H100D	CYLND CHIP C 10PF	D	
C110, 111			CC41FCH1H010C	CYLND CHIP C 1.0PF	C	
C118-120			CC41FCH1H040C	CYLND CHIP C 4.0PF	C	
C121			CC41FCH1H150J	CYLND CHIP C 15PF	J	
C124			CC41FSL1H560J	CYLND CHIP C 56PF	J	
C125			CC41FSL1H121J	CYLND CHIP C 120PF	J	
C126			CC41FSL1H560J	CYLND CHIP C 56PF	J	
C133			CK41FY1E102M	CYLND CHIP C 1000PF	M	
C134, 135			CC41FCH1HOR5C	CYLND CHIP C 0.5PF	C	
C136			CK41FY1E102M	CYLND CHIP C 1000PF	M	
C138, 139			CC41FCH1H010C	CYLND CHIP C 1.0PF	C	
C144			CK41FY1E102M	CYLND CHIP C 1000PF	M	
C153			CC41FCH1H030C	CYLND CHIP C 3.0PF	C	
C154			CC41FCH1H150J	CYLND CHIP C 15PF	J	
C155			CC41FCH1H040C	CYLND CHIP C 4.0PF	C	
C156			CC41FCH1H150J	CYLND CHIP C 15PF	J	
C157			CC41FCH1H040C	CYLND CHIP C 4.0PF	C	
C158			CC41FCH1H150J	CYLND CHIP C 15PF	J	
C159			CC41FCH1H030C	CYLND CHIP C 3.0PF	C	
C162			CC73FCH1H560J	CHIP C 56PF	J	
C166			CE04EW1C470M	ELECTRN 47UF	16WV	
C167, 168			CK41FY1E102M	CYLND CHIP C 1000PF	M	
C169			CC41FCH1HOR5C	CYLND CHIP C 0.5PF	C	
C170			CQ92M1H103K	MYLAR 0.010UF	K	
C171			C91-1083-05	FILM 0.47UF	63WV	
C173			CE04EW1C101M	ELECTRN 100UF	16WV	
C177			CE04EW1C470M	ELECTRN 47UF	16WV	
C179			CK41FY1E102M	CYLND CHIP C 1000PF	M	
C180			CQ92M1H223K	MYLAR 0.022UF	K	
C181		*	C91-1101-05	FILM 0.22UF	63WV	
C182			CE04EW1H100M	ELECTRN 10UF	50WV	
C183			C91-0117-05	CERAMIC 0.01UF	K	
C184			CS15E1VR47M	TANTAL 0.47UF	35WV	
C186			CE04EW1C470M	ELECTRN 47UF	16WV	
C187			CK45B1H182K	CERAMIC 1800PF	K	
C188			CC41FUJ1H070D	CYLND CHIP C 7.0PF	D	
C189			CC41FCH1H100D	CYLND CHIP C 10PF	D	
C191, 192			CC73FCH1H330J	CHIP C 33PF	J	
C193			CC41FCH1H050C	CYLND CHIP C 5.0PF	C	
C195			CE04EW1C470M	ELECTRN 47UF	16WV	
C197			CC41FCH1H120J	CYLND CHIP C 12PF	J	
C198			CC41FCH1H100D	CYLND CHIP C 10PF	D	
C201			CC41FSL1H270J	CYLND CHIP C 27PF	J	
C202			CC41FCH1H220J	CYLND CHIP C 22PF	J	

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C203 C204-209 C215 C217 C220			CC41FSL1H270J CC41FSL1H101J CE04EW1C470M CE04EW1C101M CK41FB1H471K	CYLND CHIP C 27PF J CYLND CHIP C 100PF J ELECTR0 47UF 16WV ELECTR0 100UF 16WV CYLND CHIP C 470PF K		
C221, 222 C223 C224 C229 C232			CC73FCH1H270J CC41FCH1H100D CK73FB1H332K CE04EW1C470M C90-2041-05	CHIP C 27PF J CYLND CHIP C 10PF D CHIP C 3300PF K ELECTR0 47UF 16WV ELECTR0 10UF 10WV		
C234 C237 C260-267 C273, 274 C277, 278			CE04EW1C470M CE04EW1C470M CK41FB1H471K CK41FB1H471K CK41FY1E102M	ELECTR0 47UF 16WV ELECTR0 47UF 16WV CYLND CHIP C 470PF K CYLND CHIP C 470PF K CYLND CHIP C 1000PF M		
C280-283 C286-293 TC1			CK41FY1E102M CC41FSL1H101J C05-0309-05	CYLND CHIP C 1000PF M CYLND CHIP C 100PF J TRIMMING CAP (40PF)		
— CN1 CN2 CN3 CN4			E23-0512-05 E40-3237-05 E40-3238-05 E04-0157-05 E40-3238-05	TERMINAL PIN CONNECTOR (2P) PIN CONNECTOR (3P) RF COAXIAL CABLE RECEPTACLE PIN CONNECTOR (3P)		
CN5 CN6 CN7 CN8 CN9			E40-3237-05 E04-0157-05 E40-3237-05 E40-3242-05 E40-5066-05	PIN CONNECTOR (2P) RF COAXIAL CABLE RECEPTACLE PIN CONNECTOR (2P) PIN CONNECTOR (7P) PIN CONNECTOR (9P)		
CN10 CN11 CN12 CN13 CN14		*	E40-5141-05 E40-5133-05 E40-3239-05 E40-3240-05 E40-3238-05	FPC CONNECTOR (26P) FPC CONNECTOR (18P) PIN CONNECTOR (4P) PIN CONNECTOR (5P) PIN CONNECTOR (3P)		
CN15			E02-2001-05	IC SOCKET (28P)		
A1 -4 A5 A6 A9 -12			F11-0817-04 F10-1222-14 F11-1021-04 F10-1344-04	SHIELDING COVER SHIELDING COVER SHIELDING COVER SHIELDING PLATE		
L1 L2 L3 L4 ,5 L6 ,7			L40-1011-14 L40-1001-14 L32-0666-15 L40-1011-14 L40-3311-14	SMALL FIXED INDUCTOR SMALL FIXED INDUCTOR COIL (VC0 91MHZ) SMALL FIXED INDUCTOR SMALL FIXED INDUCTOR		
L8 ,9 L10 L11 L12 L13 ,14			L40-3301-17 L40-1011-14 L40-1501-14 L32-0649-05 L40-1011-14	SMALL FIXED INDUCTOR SMALL FIXED INDUCTOR SMALL FIXED INDUCTOR COIL (VC0 55MHZ) SMALL FIXED INDUCTOR		
L15 ,16 L17 L18 L19 L20		*	L40-2201-17 L34-4053-05 L34-4054-15 L34-4053-05 L40-1011-14	SMALL FIXED INDUCTOR COIL (10MHZ BPF) COIL (10MHZ BPF) COIL (10MHZ BPF) SMALL FIXED INDUCTOR		

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L21, 22			L40-1211-17	SMALL FIXED INDUCTOR		
L23, 24			L40-1011-14	SMALL FIXED INDUCTOR		
L25			L40-2201-17	SMALL FIXED INDUCTOR		
L26, 27			L40-3301-17	SMALL FIXED INDUCTOR		
L28, 29			L34-4055-05	COIL (5.5MHZ BPF)		
L30, 32			L34-4057-05	COIL (78MHZ BPF)		
L33, 35			L40-1011-14	SMALL FIXED INDUCTOR		
L36			L40-1292-17	SMALL FIXED INDUCTOR		
L37, 38			L40-2201-17	SMALL FIXED INDUCTOR		
L39, 41		*	L34-4056-05	COIL (39MHZ BPF)		
L42, 44			L34-4057-05	COIL (78MHZ BPF)		
L45			L40-3391-17	SMALL FIXED INDUCTOR		
L46, 47			L40-3391-17	SMALL FIXED INDUCTOR		
L48			L40-3391-17	SMALL FIXED INDUCTOR		
L49			L40-1011-14	SMALL FIXED INDUCTOR		
L51			L40-1011-14	SMALL FIXED INDUCTOR		
L52			L40-2211-14	SMALL FIXED INDUCTOR		
L53			L40-2201-14	SMALL FIXED INDUCTOR		
L54		*	L34-4060-05	COIL (VCO 40MHZ)		
L55			L40-1011-14	SMALL FIXED INDUCTOR		
L56			L34-1124-05	COIL		
L57			L40-1011-14	SMALL FIXED INDUCTOR		
L58			L40-1011-13	SMALL FIXED INDUCTOR		
L59			L40-1011-14	SMALL FIXED INDUCTOR		
L60, 61			L40-1011-13	SMALL FIXED INDUCTOR		
L62			L40-1011-14	SMALL FIXED INDUCTOR		
X1			L77-1299-05	CRYSTAL RESONATOR (36MHZ)		
X2			L78-0015-05	RESONATOR (2.45MHZ)		
R1			R90-0229-05	MULTI-COMP 10KX8 J 1/6W		
R2			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R3			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R4			RD41FB2B393J	CYLND CHIP R 39K J 1/8W		
R5			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R6			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R7			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R8			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R9			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R10			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R11			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R12			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R13			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R14			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R15			RD41FB2B392J	CYLND CHIP R 3.9K J 1/8W		
R16, 17			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R18, 19			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R20			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R21			RD41FB2B153J	CYLND CHIP R 15K J 1/8W		
R22			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R23			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R24			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R25, 26			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R27			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R28			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R30			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		

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R31			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R32			RD41FB2B823J	CYLND CHIP R 82K J 1/8W		
R33			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R34			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R35			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R36			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R37			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R38			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R39			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R40			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R41			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R42			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R43			RD41FB2B392J	CYLND CHIP R 3.9K J 1/8W		
R44			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R45			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R46			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R47			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R48			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R49			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R50			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R52			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R53			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R54			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R55			RD41FB2B181J	CYLND CHIP R 180 J 1/8W		
R56			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R57			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R58			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R59			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R60			RD41FB2B561J	CYLND CHIP R 560 J 1/8W		
R61			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R62			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R63			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R64			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R65			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R66			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R67			RD41FB2B181J	CYLND CHIP R 180 J 1/8W		
R68			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R69			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R70			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R71			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R72 , 73			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R74			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R75			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R76			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R78			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R79			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R80			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R81			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R82			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R83			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R84			RD41FB2B331J	CYLND CHIP R 330 J 1/8W		
R85			RD41FB2B272J	CYLND CHIP R 2.7K J 1/8W		
R86			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R87			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R88			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		

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R89			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		
R90			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R91			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		
R92			RD41FB2B181J	CYLND CHIP R 180 J 1/8W		
R93			RD41FB2B561J	CYLND CHIP R 560 J 1/8W		
R94			RD41FB2B181J	CYLND CHIP R 180 J 1/8W		
R95			RD41FB2B561J	CYLND CHIP R 560 J 1/8W		
R96			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R97			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R98			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R99			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R101			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R102			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R103			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R104			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R105			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R106, 107			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R108			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R109			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R110			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R111			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R112			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R113			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R114			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R115			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R116			RD41FB2B822J	CYLND CHIP R 8.2K J 1/8W		
R117, 118			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R119			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R121			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R122, 123			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R124			RD41FB2B123J	CYLND CHIP R 12K J 1/8W		
R125			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R126			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R127			RD41FB2B331J	CYLND CHIP R 330 J 1/8W		
R128			RD41FB2B392J	CYLND CHIP R 3.9K J 1/8W		
R129			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R130			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R131			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R132			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R133			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R134			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R135			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R136			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R137			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R138			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R139			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R140			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R141			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R142-148			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R149			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R150			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R151			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R152, 153			RD41FB2B105J	CYLND CHIP R 1.0M J 1/8W		
R154			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R155			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R156			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R157			RD41FB2B184J	CYLND CHIP R 180K J 1/8W		
R158			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R159			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R160			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R163			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R164			RD41FB2B474J	CYLND CHIP R 470K J 1/8W		
R165			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R166			RD41FB2B183J	CYLND CHIP R 18K J 1/8W		
R167-169			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R170-183			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R184-188			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R189-193			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R194			RD41FB2B274J	CYLND CHIP R 270K J 1/8W		
R195			RD41FB2B684J	CYLND CHIP R 680K J 1/8W		
R196			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R197			RD41FB2B274J	CYLND CHIP R 270K J 1/8W		
R198			RD41FB2B684J	CYLND CHIP R 680K J 1/8W		
R199,200			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R201,202			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R203,204			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R205,206			RD41FB2B123J	CYLND CHIP R 12K J 1/8W		
R207,208			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R209			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R210			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R211			RD41FB2B684J	CYLND CHIP R 680K J 1/8W		
R212			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
VR1 ,2		*	R12-1067-05	TRIMMING PNT. (2.2K)		
VR3 ,4			R12-3096-05	TRIMMING PNT. (10K)		
W2 ,3			R92-1061-05	JUMPER RES 0 8HM		
D1			1SV53A	VARI-CAP DIODE		
D2 ,3			ITT310TE	VARICAP DIODE		
D4 -6			RLS135	CHIP DIODE		
D7 ,8			RLS73	CHIP DIODE		
D9 -15			RLS135	CHIP DIODE		
D16			RLS73	CHIP DIODE		
D17			1SV153	VARI-CAP DIODE		
D18 -21			RLS73	CHIP DIODE		
D24 -27			RLS73	CHIP DIODE		
D29			1SS133	DIODE		A
D31			1SS133	DIODE		
IC1		*	M54927P	IC(FREQ SYNTHESIZER PLL)		
IC2			M54459L	IC(PRE SCALER)		
IC3			SN74LS90N	IC(DECADE COUNTERS)		
IC4		*	M54927P	IC(FREQ SYNTHESIZER PLL)		
IC5			M54460L	IC(PRE SCALER)		
IC6			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC7			SN74LS90N	IC(DECADE COUNTERS)		
IC8			M74LS93P	IC		
IC9 -11			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC12			SN76514N	IC		
IC13			MB87006	IC(FREQ SYNTHESIZER PLL)		
IC14		*	M54927P	IC(FREQ SYNTHESIZER PLL)		
IC15			PST520D	IC(LOW POWER RESET)		
IC16			TC4069UBP	IC(INVERTER X6)		

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IC17 IC18 IC19 IC20 IC21		*	NE555C BU18400A SN74LS138N TC5518CPL-20 27C128-25JAJ2	IC(TIMER) IC(CPU) IC(DECODERS) RAM IC ROM IC(MBM)		
IC22-24 IC25 IC26 IC27 01 .2		*	TMP8255AP-5 TC4069UBP LZ92K37 MB4052 2SC2668(Y)	IC(PROGRAMMABLE INTERFACE) IC(INVERTER X6) IC(COUNTER) IC(4CH 8BIT A/D CONVERTER(ADC) TRANSISTOR		
03 04 05 .6 07 .8 09			2SC2458(Y) 2SC1959(Y) 2SC2668(Y) 2SC2458(Y) 2SC2787(L)	TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR		
010 -15 016 -21 022 -24 025 026			2SC2668(Y) 2SC2459(BL) 2SC2668(Y) DTA124ES DTC124ES	TRANSISTOR TRANSISTOR TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
027 -29 030 -40 041 -43			DTA143ES DTC144WS DTC143TS	DIGITAL TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W)						
D18 D19 D20 .21			B30-0855-05 B30-0857-05 B30-0856-05	LED(RED) ON AIR LED(YLW) M. SCR LED(GRN) F. LOCK, 1MHZ		
C1 .2 C3 C4 C5 C6			CK73FF1E104Z CK73FB1H103K CK73FF1E104Z C91-0119-05 CK73FF1E104Z	CHIP C 0.10UF Z CHIP C 0.010UF K CHIP C 0.10UF Z CERAMIC 0.047UF K CHIP C 0.10UF Z		
C7 .8 C9 C10 C11 C12			CK73FB1H103K CE04EW1C220M CE04EW1H100M CE04EW1H470M CK73FF1H473Z	CHIP C 0.010UF K ELECTRO 22UF 16WV ELECTRO 10UF 50WV ELECTRO 47UF 50WV CHIP C 0.047UF Z		
C13 C14 .15 C16 C21 C22			C90-2009-05 CK73FF1E104Z CK73FB1H103K C91-0105-05 CE04EW1H470M	ELECTRO 470UF 16WV CHIP C 0.10UF Z CHIP C 0.010UF K CERAMIC 0.0047UF K ELECTRO 47UF 50WV		
TC1 .2			C05-0315-05	TRIMMING CAP (60PF)	W	
CN1 CN2 .3 CN4 CN5 J1	1H	*	E40-3237-05 E40-5131-05 E40-5133-05 E40-3252-05 E06-0858-05	PIN CONNECTOR (2P) FPC CONNECTOR (16P) FPC CONNECTOR (18P) PIN CONNECTOR CYLINDRICAL RECEPTACLE(8P,MIC)		
A1			F10-1344-04	SHIELDING PLATE		
		*	G13-0862-04	CUSHION		
		*	J19-1427-03	HOLDER		

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L1 -3 L4 L5			L40-1011-13 L40-2292-14 L40-2792-14	SMALL FIXED INDUCTOR SMALL FIXED INDUCTOR SMALL FIXED INDUCTOR	W W	
CP1 CP2 CP3 R2 R5			R90-0462-05 R90-0274-05 R90-0462-05 RD41FB2B222J RD41FB2B562J	MULTI-COMP 47KX8 J 1/4W MULTI-COMP 47KX5 J 1/6W MULTI-COMP 47KX8 J 1/4W CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 5.6K J 1/8W		
R6 R7 R8 R9 R10			RD41FB2B152J RD41FB2B102J RD41FB2B101J RD41FB2B152J RD41FB2B102J	CYLND CHIP R 1.5K J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 1.5K J 1/8W CYLND CHIP R 1.0K J 1/8W		
R11 R12 R13 -15 R16 VR1			RD41FB2B101J RD41FB2B471J RD41FB2B560J RD41FB2B471J R13-1402-05	CYLND CHIP R 100 J 1/8W CYLND CHIP R 470 J 1/8W CYLND CHIP R 56 J 1/8W CYLND CHIP R 470 J 1/8W SLIDE TYPE POT(1K,1K)POWER		
VR2 ,3 VR4 VR5		*	R13-3405-05 R13-1402-05 R12-3129-05	SLIDE TYPE POT(10K)MIC,RF GAIN SLIDE TYPE POT(1K,1K)NB TRIMMING POT. (22K)		
S1 -6 S7 S8 ,9 S10 -20 S21			S40-2440-15 S31-2409-05 S40-2440-15 S50-1412-05 S40-2441-15	PUSH SWITCH SLIDE SWITCH (CW) PUSH SWITCH TACT SWITCH PUSH SWITCH (1MHZ)		
S22 -24 S25			S50-1412-05 S40-2441-15	TACT SWITCH PUSH SWITCH (RIT)		
- D1 -16 D17 IC1 01		*	FIP12TM7 RLS73 RLZJ8. 2A UPD6300C DTA114EK	FLUORESCENT INDICATOR TUBE CHIP DIODE CHIP ZENER DIODE IC(FL LATCH DRIVER) DIGITAL TRANSISTOR		
S26 Z1		*	W02-0388-05 W02-0804-05	ENCODER ASSY ELECTRIC UNIT		
SIGNAL UNIT (X57-3190-00) : TS-680S (X57-3200-XX) -10 : TS-140S(K, M, T) -61 : TS-140S(W)						
C2 C3 C4 C5 C6 ,7			CK73EF1E474Z CK41FY1E152M CK73FB1H272K CK41FY1E152M CK73EF1E474Z	CHIP C 0.47UF Z CYLND CHIP C 1500PF M CHIP C 2700PF K CYLND CHIP C 1500PF M CHIP C 0.47UF Z		
C9 C10 ,11 C13 C14 C16			CE04EW1H010M CK41FB1H471K CK41FY1E152M CK73FB1H122K CE04EW1H010M	ELECTRO 1.0UF 50WV CYLND CHIP C 470PF K CYLND CHIP C 1500PF M CHIP C 1200PF K ELECTRO 1.0UF 50WV		
C17 C23 C24 C25 C27			CC41FCH1H150J CC41FSL1H820J CC41FCH1H220J CC41FSL1H121J CC41FSL1H390J	CYLND CHIP C 15PF J CYLND CHIP C 82PF J CYLND CHIP C 22PF J CYLND CHIP C 120PF J CYLND CHIP C 39PF J		
C28 ,29 C31			CK41FW1H681M CE04EW1H010M	CYLND CHIP C 680PF M ELECTRO 1.0UF 50WV		

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C32			CK41FW1H681M	CYLND CHIP C 680PF M		
C33			CK41FB1H471K	CYLND CHIP C 470PF K		
C35			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C36, 37			CK73EF1E474Z	CHIP C 0.47UF Z		
C38			CK73EF1E474Z	CHIP C 0.47UF Z		B
C39			CK73EF1E474Z	CHIP C 0.47UF Z		
C47			CK41FB1H271K	CYLND CHIP C 270PF K		
C48			CK41FB1H471K	CYLND CHIP C 470PF K		
C51			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C52			CC41FSL1H151J	CYLND CHIP C 150PF J		
C53			CK41FA1H181K	CYLND CHIP C 180PF K		
C55			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C56			CK41FY1E222M	CYLND CHIP C 2200PF M		
C57			CC41FSL1H330J	CYLND CHIP C 33PF J		B
C58			CK41FY1E222M	CYLND CHIP C 2200PF M		B
C60			CC41FSL1H560J	CYLND CHIP C 56PF J		B
C62			CE04EW1H010M	ELECTR0 1.0UF 50WV		B
C64			CC41FCH1H120J	CYLND CHIP C 12PF J		B
C67			CC41FSL1H270J	CYLND CHIP C 27PF J		B
C70			CC45SL1H151J	CERAMIC 150PF J		
C71			CK41FA1H181K	CYLND CHIP C 180PF K		
C72			CC45SL1H151J	CERAMIC 150PF J		
C74			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C76			CC41FCH1H050C	CYLND CHIP C 5.0PF C		
C77			CE04EW1E470M	ELECTR0 47UF 25WV		
C78			CC41FCH1H220J	CYLND CHIP C 22PF J		
C79			CC73FCH1H330J	CHIP C 33PF J		
C80			CC41FCH1H050C	CYLND CHIP C 5.0PF C		
C83			CE04EW1E470M	ELECTR0 47UF 25WV		
C84			CC41FCH1H100D	CYLND CHIP C 10PF D		
C85			CC41FCH1H220J	CYLND CHIP C 22PF J		
C88, 89			CC41FCH1H050C	CYLND CHIP C 5.0PF C		
C90			CC41FCH1H180J	CYLND CHIP C 18PF J		
C91			CE04EW1E470M	ELECTR0 47UF 25WV		
C94			C91-0119-05	CERAMIC 0.047UF K		
C95			CC41FCH1H220J	CYLND CHIP C 22PF J		B
C96			CE04EW1E470M	ELECTR0 47UF 25WV		B
C98			CC41FCH1H150J	CYLND CHIP C 15PF J		B
C100			CK73FB1E223K	CHIP C 0.022UF K		
C103			CC41FCH1H180J	CYLND CHIP C 18PF J		
C104			CC41FCH1H220J	CYLND CHIP C 22PF J		
C107			CC41FSL1H330J	CYLND CHIP C 33PF J		
C112			CC41FSL1H820J	CYLND CHIP C 82PF J		B
C113			CC41FCH1H150J	CYLND CHIP C 15PF J		B
C116, 117			CK73FB1H472K	CHIP C 4700PF K		
C121			CC41FCH1H060D	CYLND CHIP C 6.0PF D		
C122			CC41FCH1H020C	CYLND CHIP C 2.0PF C		
C123			CC41FCH1H040C	CYLND CHIP C 4.0PF C		
C128, 129			CK73FB1H472K	CHIP C 4700PF K		
C132			CK73FB1E223K	CHIP C 0.022UF K		
C145, 146			CC41FCH1H100D	CYLND CHIP C 10PF D		
C164, 165			CE04EW1HR22M	ELECTR0 0.22UF 50WV		
C166			CE04EW1E470M	ELECTR0 47UF 25WV		
C171			CC41FCH1H150J	CYLND CHIP C 15PF J		
C173			CE04EW1HR47M	ELECTR0 0.47UF 50WV		

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C174			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C176			CE04EW1HR47M	ELECTR0 0.47UF 50WV		
C177			CC41FSL1H101J	CYLND CHIP C 100PF J		
C187,188			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C190			CC41FSL1H101J	CYLND CHIP C 100PF J		
C194			CE04EW1H2R2M	ELECTR0 2.2UF 50WV		
C198			CC41FCH1H120J	CYLND CHIP C 12PF J		
C201			C90-2022-05	NS 22UF 16WV		
C202			CC41FSL1H101J	CYLND CHIP C 100PF J		
C203			CE04EW1H100M	ELECTR0 10UF 50WV		
C204,205			CC41FSL1H470J	CYLND CHIP C 47PF J		
C206,207			CK41FB1H221K	CYLND CHIP C 220PF K		
C209			CE04EW1H100M	ELECTR0 10UF 50WV		
C210			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C211			CK73FB1E473M	CHIP C 0.047UF M		A
C212			CK73FF1E473Z	CHIP C 0.047UF Z		
C213			CE04EW1E470M	ELECTR0 47UF 25WV		
C214			CE04EW1HOR1M	ELECTR0 0.1UF 50WV		
C215			CE04EW1H100M	ELECTR0 10UF 50WV		
C216,217			CK73FB1H472K	CHIP C 4700PF K		
C218			CE04EW1H100M	ELECTR0 10UF 50WV		
C219			C90-0866-05	ELECTR0 470UF 6.3WV		
C220			CE04EW1C102M	ELECTR0 1000UF 16WV		
C221			CK73FB1E223K	CHIP C 0.022UF K		
C224			CE04EW1A221M	ELECTR0 220UF 10WV		
C226			CK41FY1E222M	CYLND CHIP C 2200PF M		
C227			CK41FB1H471K	CYLND CHIP C 470PF K		
C229			CK41FY1E152M	CYLND CHIP C 1500PF M		
C230			CK73FB1E223K	CHIP C 0.022UF K		
C232			CE04EW1E220M	ELECTR0 22UF 25WV		
C233			CK73FB1H562K	CHIP C 5600PF K		
C234			CK73FB1E223K	CHIP C 0.022UF K		
C235			CC41FSL1H470J	CYLND CHIP C 47PF J		
C236			CE04EW1E220M	ELECTR0 22UF 25WV		
C237			CE04EW1HR47M	ELECTR0 0.47UF 50WV		
C238			CE04EW1E330M	ELECTR0 33UF 25WV		
C239			CE04EW1H100M	ELECTR0 10UF 50WV		
C240			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C241,242			CE04EW1E470M	ELECTR0 47UF 25WV		
C243			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C244			CE04EW1H100M	ELECTR0 10UF 50WV		
C245			CK73FB1H123K	CHIP C 0.012UF K		
C247,248			CE04EW1E470M	ELECTR0 47UF 25WV		
C249			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C252			CK45E2H222P	CERAMIC 2200PF P		
C254			CE04EW1E330M	ELECTR0 33UF 25WV		
C258,259			CK73FB1H472K	CHIP C 4700PF K		
C261-264			CK73FB1H472K	CHIP C 4700PF K		
C266			CK73FB1H472K	CHIP C 4700PF K		
C268			CC41FSL1H680J	CYLND CHIP C 68PF J		
C271			CK73FB1E223K	CHIP C 0.022UF K		
C273			CK73FB1E223K	CHIP C 0.022UF K		
C278			CC41FSL1H330J	CYLND CHIP C 33PF J		B
C279			CC41FSL1H820J	CYLND CHIP C 82PF J		B
C280			CC41FSL1H270J	CYLND CHIP C 27PF J		B

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C281			CC41FSL1H121J	CYLND CHIP C 120PF J		B
C282			CC41FSL1H470J	CYLND CHIP C 47PF J		B
C287			CC41FSL1H470J	CYLND CHIP C 47PF J		
C288			CC41FSL1H270J	CYLND CHIP C 27PF J		
C289			CC41FSL1H121J	CYLND CHIP C 120PF J		
C290			CC41FSL1H330J	CYLND CHIP C 33PF J		
C291			CC41FSL1H390J	CYLND CHIP C 39PF J		
C294			CK73FB1E223K	CHIP C 0.022UF K		
C295			CE04EW1H100M	ELECTR0 10UF 50WV		
C297			CK73FB1H472K	CHIP C 4700PF K		
C301			CC41FSL1H470J	CYLND CHIP C 47PF J		
C308			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C309			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C312			CE04EW1H100M	ELECTR0 10UF 50WV		
C314			CE04EW1HR47M	ELECTR0 0.47UF 50WV		
C315			CE04EW1E470M	ELECTR0 47UF 25WV		
C316			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C318			CE04EW1HR47M	ELECTR0 0.47UF 50WV		
C319,320			CE04EW1H100M	ELECTR0 10UF 50WV		
C322			CE04EW1HR47M	ELECTR0 0.47UF 50WV		
C326			CE04EW1C102M	ELECTR0 1000UF 16WV		
C327			CE04EW1E470M	ELECTR0 47UF 25WV		
C330			CE04EW1E470M	ELECTR0 47UF 25WV		
C334			CC41FSL1H470J	CYLND CHIP C 47PF J		B
C336			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C338			CK73FB1E223K	CHIP C 0.022UF K		
C340			CK41FY1B682M	CYLND CHIP C 6800PF M		
C354			CE04EW1H4R7M	ELECTR0 4.7UF 50WV		
C356			CC41FSL1H470J	CYLND CHIP C 47PF J		B
C357			CE04EW1A101M	ELECTR0 100UF 10WV		
C358			CE04EW1H010M	ELECTR0 1.0UF 50WV		
C359			CK73FF1E473Z	CHIP C 0.047UF Z		
C362			CC41FSL1H101J	CYLND CHIP C 100PF J		
C363			CC41FCH1H180J	CYLND CHIP C 18PF J		
C365			CC41FCH1H040C	CYLND CHIP C 4.0PF C		
C367			CC41FSL1H470J	CYLND CHIP C 47PF J		
C368			CC41FSL1H151J	CYLND CHIP C 150PF J		B
C369			CK73EF1C105Z	CHIP C 1.0UF Z		
C370			CC41FCH1H040C	CYLND CHIP C 4.0PF C		
C372			C91-0119-05	CERAMIC 0.047UF K		
C373			CE04EW1E101M	ELECTR0 100UF 25WV		
C374			C91-0117-05	CERAMIC 0.01UF K		
C376			CK73FB1E473M	CHIP C 0.047UF M		
C501			CE04EW1H100M	ELECTR0 10UF 50WV		A
C502			CE04EW1E470M	ELECTR0 47UF 25WV		A
C505			CK73FF1E473Z	CHIP C 0.047UF Z		A
CN1,2			E40-5131-05	FPC CONNECTOR (16P)		
CN3			E40-5141-05	FPC CONNECTOR (26P)		
CN4			E40-3238-05	PIN CONNECTOR (3P)		
CN5			E40-3242-05	PIN CONNECTOR (7P)		
CN6		*	E31-3320-05	CONNECTING WIRE (VCV)		
CN7			E40-3237-05	PIN CONNECTOR (2P)		
CN8			E40-3239-05	PIN CONNECTOR (4P)		
CN9			E40-3241-05	PIN CONNECTOR (6P)		

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CN10			E40-3240-05	PIN CONNECTOR (5P)		
CN11			E40-3238-05	PIN CONNECTOR (3P)		
CN12			E40-3237-05	PIN CONNECTOR (2P)		
CN13			E40-3239-05	PIN CONNECTOR (4P)		
CN14			E40-3237-05	PIN CONNECTOR (2P)		
CN15			E40-5067-05	PIN CONNECTOR (10P)		
CN16			E40-3237-05	PIN CONNECTOR (2P)		
CN17			E40-3239-05	PIN CONNECTOR (4P)		
CN18, 19			E40-3237-05	PIN CONNECTOR (2P)		
CN20-22			E04-0157-05	RF COAXIAL CABLE RECEPTACLE		
CN23			E06-0752-05	CYLINDRICAL RECEPTACLE(REMOTE)		
CN24			E11-0418-05	PHONE JACK (KEY)		
CN25			E11-0414-05	PHONE JACK (EXT,5P)		
CN26		*	E06-0859-05	CYLINDRICAL RECEPTACLE(ACC3)		
CN27			E40-3266-05	PIN CONNECTOR (8P)		
CN28			E06-1351-05	CYLINDRICAL RECEPTACLE(ACC2)		
CN501			E40-3237-05	PIN CONNECTOR (2P)		
TP1			E23-0512-05	TERMINAL		
TP2 ,3			E23-0465-05	TERMINAL		
A1		*	F11-1071-14	SHIELDING CASE		
A2		*	F11-1072-14	SHIELDING CASE		
A3 ,4		*	F11-1073-04	SHIELDING CASE		
A5			F10-1344-04	SHIELDING PLATE		
A6		*	F02-0435-04	HEAT SINK		
A9		*	F10-1376-04	SHIELDING PLATE		
-			G02-0574-04	FLAT SPRING		
CF1			L72-0356-05	CERAMIC FILTER (SSB)		
CF2			L72-0355-05	CERAMIC FILTER (AM)		
CF3			L72-0315-05	CERAMIC FILTER (FM)		
L1		*	L34-4046-15	COIL		
L2			L40-8291-17	SMALL FIXED INDUCTOR(8.2UH)		
L3			L40-1001-17	SMALL FIXED INDUCTOR(10UH)		
L4 ,5			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L6			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L7			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L8			L40-3391-17	SMALL FIXED INDUCTOR(3.3UH)		
L9			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L10			L40-5691-17	SMALL FIXED INDUCTOR(5.6UH)		
L11			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L12			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
L13			L40-3382-17	SMALL FIXED INDUCTOR(0.33UH)		
L14			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
L15 ,16			L40-3991-17	SMALL FIXED INDUCTOR(3.3UH)		
L17			L40-4791-17	SMALL FIXED INDUCTOR(4.7UH)		
L18			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L20			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L21			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L22			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L23			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L24			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L25 ,26			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
L27			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L28			L40-1292-17	SMALL FIXED INDUCTOR(1.2UH)		

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L29			L40-6882-17	SMALL FIXED INDUCTOR(0.68UH)		
L31			L40-1292-17	SMALL FIXED INDUCTOR(1.2UH)		
L32			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L33			L40-4782-17	SMALL FIXED INDUCTOR(0.47UH)		
L34			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L35			L40-4782-17	SMALL FIXED INDUCTOR(0.47UH)		
L36			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L37			L34-4002-05	COIL		B
L38			L40-1001-17	SMALL FIXED INDUCTOR(10UH)		B
L39			L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L40 .41		*	L34-1204-05	COIL (8T)		B
L42			L34-4002-05	COIL		B
L44			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		B
L45			L40-1001-17	SMALL FIXED INDUCTOR(10UH)		B
L46		*	L34-4046-15	COIL		B
L47			L34-1162-05	COIL (6T)		B
L48			L19-0344-05	TOROIDAL COIL		
L49			L19-0324-05	TOROIDAL COIL		
L50 .51			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L52			L34-2267-05	COIL		
L53		*	L34-4047-05	COIL		
L54 .55		*	L34-4048-05	COIL		
L56		*	L40-1001-17	SMALL FIXED INDUCTOR(10UH)		
L57		*	L34-4049-05	COIL		
L58			L40-1011-17	SMALL FIXED INDUCTOR(100UH)		
L59 .60			L34-0664-05	COIL		
L61			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L64			L34-2124-05	COIL		
L65			L34-0945-05	COIL		
L66			L40-6825-04	SMALL FIXED INDUCTOR(6.8MH)		
L67			L40-2201-14	SMALL FIXED INDUCTOR(22UH)		
L68			L32-0198-05	COIL		
L69			L40-1801-14	SMALL FIXED INDUCTOR(18UH)		
L70			L32-0649-05	COIL		
L71			L40-1501-14	SMALL FIXED INDUCTOR(4.7UH)		B
L72			L32-0639-05	COIL		
L73			L40-4791-14	SMALL FIXED INDUCTOR(10UH)		
L74			L32-0666-15	COIL		B
L75			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L76			L40-1511-17	SMALL FIXED INDUCTOR(150UH)		
L77			L40-4782-17	SMALL FIXED INDUCTOR(0.47UH)		
L78			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L79			L19-0344-05	TOROIDAL COIL		
L80 .81			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L82			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		
L83			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L84			L34-0540-05	COIL		
L85			L34-0863-05	COIL		
L86			L30-0503-05	COIL		
L87			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L88			L40-3391-13	SMALL FIXED INDUCTOR(3.3UH)		
L89			L34-2283-05	COIL		
L90 .93		*	L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L94			L39-0432-05	TOROIDAL COIL		
L95			L34-2289-05	COIL		

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L96		*	L39-0440-05	TOROIDAL COIL		
L97		*	L34-4046-15	COIL		
L98			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		B
L99			L40-3382-17	SMALL FIXED INDUCTOR(0.33UH)		
L100			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
L101			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		B
L102		*	L34-1204-05	COIL (8T)		B
L103-105			L34-1162-05	COIL (6T)		B
L106,107			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		B
L108			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L109			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L110			L40-4701-14	SMALL FIXED INDUCTOR(47UH)		
L111			L19-0328-05	TOROIDAL COIL		
L112			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L113			L34-2124-05	COIL		
L114			L40-1011-17	SMALL FIXED INDUCTOR(100UH)		
L117			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L118-120			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L121,122			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L124,125			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L126			L40-1011-17	SMALL FIXED INDUCTOR(100UH)		
L127,128			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
XF1		*	L71-0275-05	MCF		
-			ND9-0641-05	SCREW		
CP1			R90-0455-05	MULTI-COMP 4.7KX8		
CP2			R90-0286-05	MULTI-COMP 4.7KX4		
R1			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R2			RD41FB2B470J	CYLND CHIP R 47 J 1/8W		
R3			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R4			RD41FB2B680J	CYLND CHIP R 68 J 1/8W		
R5			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R7			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R8			RD41FB2B680J	CYLND CHIP R 68 J 1/8W		
R9			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R10 ,11			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R12			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R13			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R14			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R15			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R16			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R17			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R18			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R19			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R20			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R21			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R22			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R23			RD41FB2B330J	CYLND CHIP R 33 J 1/8W		B
R24			RD41FB2B820J	CYLND CHIP R 82 J 1/8W		B
R25			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		B
R26			RD41FB2B100J	CYLND CHIP R 10 J 1/8W		B
R27			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		B
R28			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R29			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		B
R30			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		B

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R31			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		B
R32			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		B
R34			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R35			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R36			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		B
R37			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		B
R38			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		B
R39 .40			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R41			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R42			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		B
R43			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R44			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R45			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R46 .47			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R48			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R49			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R50 .51			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R52			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R53			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R54			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R55			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		B
R56			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		B
R57			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		B
R58			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		B
R59			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R60			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R61			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R62 .63			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R64			RD41FB2B330J	CYLND CHIP R 33 J 1/8W		
R65			RD41FB2B271J	CYLND CHIP R 270 J 1/8W		
R66			RD41FB2B151J	CYLND CHIP R 150 J 1/8W		
R67			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R68			RD41FB2B470J	CYLND CHIP R 47 J 1/8W		
R69			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R70			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R71			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R72			RD41FB2B150J	CYLND CHIP R 15 J 1/8W		
R73 .75			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R76 .77			RD41FB2B821J	CYLND CHIP R 820 J 1/8W		
R78 .80			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R81			RD41FB2B393J	CYLND CHIP R 39K J 1/8W		
R82			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R83			RD41FB2B474J	CYLND CHIP R 470K J 1/8W		
R84			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R85			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R86			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R87 .88			RD41FB2B151J	CYLND CHIP R 150 J 1/8W		
R89			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R91 .92			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R93			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R94 .95			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R96			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R97			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R98 -100			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R101			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		

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R102			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R103, 104			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R105			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R106			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R107			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R108			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R109			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R110			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R111			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R112			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R113			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R114			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R115			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R116			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R117			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R118			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R119			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R120			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R121			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R122			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R123, 124			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R125			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R126			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R127			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R128			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R129			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R130			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R131			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R132			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R133			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R134, 135			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R136, 137			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R138			RD41FB2B224J	CYLND CHIP R 220K J 1/8W		
R139			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R140			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R141			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R142			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R143			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R145, 146			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R147			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R148			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R149			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R151			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R152			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R153			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R154			RD41FB2B153J	CYLND CHIP R 15K J 1/8W		
R155			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R156			RD41FB2B683J	CYLND CHIP R 68K J 1/8W		
R157			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R158, 159			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R160			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R161			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R162			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R163			RD41FB2B563J	CYLND CHIP R 56K J 1/8W		
R164			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		

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R165			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R166			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R167			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R168			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R169, 170			RD41FB2B474J	CYLND CHIP R 470K J 1/8W		
R171			RD41FB2B273J	CYLND CHIP R 27K J 1/8W		
R172			RD41FB2B153J	CYLND CHIP R 15K J 1/8W		
R173			RD41FB2B334J	CYLND CHIP R 330K J 1/8W		
R174			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R175			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R176			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R177			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R178			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R179			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R180			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R181			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R182			RD41FB2B224J	CYLND CHIP R 220K J 1/8W		
R183			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R184			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R185			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R186			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R187			RD41FB2B224J	CYLND CHIP R 220K J 1/8W		
R188			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R189			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R190			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R191			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R192, 193			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R194			RD41FB2B224J	CYLND CHIP R 220K J 1/8W		
R195			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R196, 197			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R198			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R199			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R200			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R201			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R202			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R203			RD41FB2B821J	CYLND CHIP R 820 J 1/8W		
R204			RD41FB2B331J	CYLND CHIP R 330 J 1/8W		
R205			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R206			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R207			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R208			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R209			RK73FB2A2R2J	CHIP R 2.2 J 1/10W		
R210			RD41FB2B331J	CYLND CHIP R 330 J 1/8W		
R211			RK73FB2A2R2J	CHIP R 2.2 J 1/10W		
R212			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R213			RD41FB2B823J	CYLND CHIP R 82K J 1/8W		
R214			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R215, 216			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R217			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R218			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R219			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R220			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R221			RD41FB2B153J	CYLND CHIP R 15K J 1/8W		
R224			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R225			RD41FB2B821J	CYLND CHIP R 820 J 1/8W		

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R226, 227			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R228			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R229, 230			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		
R231			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R232			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R233			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R234			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R235			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R236			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R237			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R238			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R239			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R240			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R241			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R242			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R243, 244			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R246-248			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R250			RD41FB2B273J	CYLND CHIP R 27K J 1/8W		
R251			RD41FB2B563J	CYLND CHIP R 56K J 1/8W		
R252			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R253-256			RD41FB2B330J	CYLND CHIP R 33 J 1/8W		
R257			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R258			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R259, 260			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R261			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R262			RD41FB2B561J	CYLND CHIP R 560 J 1/8W		
R263			RD14BB2E100J	RD 10 J 1/4W		
R264			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R265			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R266			RD41FB2B124J	CYLND CHIP R 120K J 1/8W		
R267			RD41FB2B221J	CYLND CHIP R 220 J 1/8W		
R268			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R269			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R270			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R271			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R272			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R273			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R274			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R275, 276			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R277			RD14CB2C224J	RD 220K J 1/6W		
R278			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R279			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R280			RD14BB2C4R7J	RD 4.7 J 1/6W		
R281			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R282			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R284			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R285			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R286			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R287			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R288			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R289, 290			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R291			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R292			RD41FB2B562J	CYLND CHIP R 5.6K J 1/8W		
R293			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R294			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		

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R295 R296 R297 R298 R299			RD41FB2B102J RD41FB2B222J RD41FB2B101J RD41FB2B103J RD41FB2B682J	CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 6.8K J 1/8W		
R300 R301 R302 R303 R304			RD41FB2B563J RD41FB2B472J RD41FB2B333J RD41FB2B124J RD41FB2B221J	CYLND CHIP R 56K J 1/8W CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 33K J 1/8W CYLND CHIP R 120K J 1/8W CYLND CHIP R 220 J 1/8W		
R305 R306 R307 R308 R309			RD41FB2B102J RD41FB2B562J RD41FB2B223J RD41FB2B483J RD41FB2B821J	CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 5.6K J 1/8W CYLND CHIP R 22K J 1/8W CYLND CHIP R 68K J 1/8W CYLND CHIP R 820 J 1/8W		
R310 R311 R312 R313 R314, 317			RD41FB2B222J RD41FB2B104J RD41FB2B333J RD41FB2B473J RD41FB2B564J	CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 3.3K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 560K J 1/8W		
R318 R319 R320 R321 R322			RD41FB2B103J RD41FB2B102J RD41FB2B104J RD41FB2B103J RD41FB2B473J	CYLND CHIP R 10K J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 47K J 1/8W		
R323 R324 R325, 326 R327 R328			RD41FB2B104J RD41FB2B473J RD41FB2B1104J RD41FB2B103J RD41FB2B102J	CYLND CHIP R 100K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 1.0K J 1/8W		
R329, 330 R331 R332 R333 R334 R335			RD41FB2B473J RD41FB2B562J RD41FB2B333J RD41FB2B224J RD41FB2B562J	CYLND CHIP R 47K J 1/8W CYLND CHIP R 5.6K J 1/8W CYLND CHIP R 3.3K J 1/8W CYLND CHIP R 220K J 1/8W CYLND CHIP R 5.6K J 1/8W		
R340 R341 R342 R343 R344, 346			RD41FB2B152J RD41FB2B101J RD41FB2B101J RD41FB2B471J RD41FB2B101J	CYLND CHIP R 1.5K J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 470 J 1/8W CYLND CHIP R 100 J 1/8W		
R347 R348 R349 R350, 352 R353, 354			RD41FB2B472J RD41FB2B224J RD41FB2B473J RD41FB2B102J RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 220K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 4.7K J 1/8W		
R355 R356 R357 R359 R360			RD41FB2B103J RD41FB2B104J RD41FB2B472J RD41FB2B222J RD41FB2B103J	CYLND CHIP R 10K J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 10K J 1/8W		
R361 R362 R363 R365 R366			RD41FB2B222J RD41FB2B104J RD41FB2B223J RD41FB2B102J RD41FB2B472J	CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 22K J 1/8W CYLND CHIP R 1.0K J 1/8W CYLND CHIP R 4.7K J 1/8W		

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R367 R368, 369 R370 R371 R372			RD41FB2B105J RD41FB2B104J RD14CB2C103J RD14BB2C100J RD41FB2B332J	CYLND CHIP R 1.0M J 1/8W CYLND CHIP R 100K J 1/8W RD 10K J 1/6W RD 10 J 1/6W CYLND CHIP R 3.3K J 1/8W		
R373 R501-504 R505 VR1 VR2			RD41FB2B101J RD41FB2B103J RD41FB2B102J R12-0435-05 R12-1431-05	CYLND CHIP R 100 J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 1.0K J 1/8W TRIMMING PNT. (300) TRIMMING PNT. (1K)		A A
VR3, 4 VR5, 6 VR7 VR8 VR9, 10		*	R12-2414-05 R12-3447-05 R05-5401-05 R12-1432-05 R12-7407-05	TRIMMING PNT. (5K) TRIMMING PNT. (10K) POTENTIOMETER (100K) TRIMMING PNT. (2K) TRIMMING PNT. (500K)		
VR11 VR12 VR13 VR14 VR15			R12-7407-05 R12-7407-05 R12-5418-05 R12-5417-05 R12-5417-05	TRIMMING PNT. (500K) TRIMMING PNT. (500K) TRIMMING PNT. (200K) TRIMMING PNT. (100K) TRIMMING PNT. (100K)		B B
VR16, 17 VR18 VR19 VR20, 21 VR22			R12-4414-05 R12-0435-05 R12-1431-05 R12-4414-05 R12-3448-05	TRIMMING PNT. (50K) TRIMMING PNT. (300) TRIMMING PNT. (1K) TRIMMING PNT. (50K) TRIMMING PNT. (20K)		
VR23 VR24 VR25 VR26 VR501		*	R12-4414-05 R12-3447-05 R12-1431-05 R12-3447-05 R05-3443-05	TRIMMING PNT. (50K) TRIMMING PNT. (10K) TRIMMING PNT. (1K) TRIMMING PNT. (10K) POTENTIOMETER (10K)		A A
VR502 W1 -7 W8 W9 W10		*	R05-0402-05 R92-0150-05 R92-1061-05 R92-0150-05 R92-0687-05	POTENTIOMETER (300) JUMPER REST 0 OHM JUMPER REST 0 OHM JUMPER REST 0 OHM CHIP R 0 OHM		A B
W11 W12 W13, 14 W501, 502 W503			R92-0687-05 R92-1061-05 R92-1061-05 R92-1061-05 R92-0687-05	CHIP R 0 OHM JUMPER REST 0 OHM JUMPER REST 0 OHM JUMPER REST 0 OHM CHIP R 0 OHM	W	A A A
W504, 505 W506			R92-0338-05 R92-0687-05	CLYND CHIP R 0 OHM CHIP R 0 OHM		A A
K1 K2, 3 K4 S1 S2		*	S51-1436-05 S51-2422-05 S51-1432-05 S31-1411-05 S31-1411-05	RELAY (ATT) RELAY RELAY SLIDE SWITCH SLIDE SWITCH		B B
D1 -3 D5 D6 D7, 8 D9		*	DAN235(K) US1090 V08(G) RLS135 V08(G)	CHIP DIODE DIODE DIODE CHIP DIODE DIODE		
D10 D11			US1090 RLS135	DIODE CHIP DIODE		

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D12		*	DAN235(K)	CHIP DIODE		
D13 -20			RLS135	CHIP DIODE		
D21 -22			RLS135	CHIP DIODE		B
D23			1S1555	DIODE		
D24			DAN202(K)	CHIP DIODE		B
D25			1S1555	DIODE		B
D26			DAP202(K)	CHIP DIODE		
D27			RLS73	CHIP DIODE		
D28 -29			DAP202(K)	CHIP DIODE		
D30			UZ3.0B	ZENER DIODE		
D31			DAP202(K)	CHIP DIODE		B
D33			RLS73	CHIP DIODE		
D34 -37			ITT310TE	VARI-CAP DIODE		
D38			RLS135	CHIP DIODE		
D39 -40			ITT310TE	VARI-CAP DIODE		
D41			RLS135	CHIP DIODE		
D42 -43			ITT310TE	VARI-CAP DIODE		B
D44			RLS135	CHIP DIODE		B
D45 -46			RLS135	CHIP DIODE		
D47			MI204	DIODE		
D48			DAN202(K)	CHIP DIODE		
D49			RLS73	CHIP DIODE		
D50 -53			RLS135	CHIP DIODE		
D54 -56			RLS73	CHIP DIODE		
D57			DAN202(K)	CHIP DIODE		
D58 -60			RLS73	CHIP DIODE		
D61			DAN202(K)	CHIP DIODE		
D62 -67			RLS73	CHIP DIODE		
D68 -69			DAN202(K)	CHIP DIODE		
D70			RLS73	CHIP DIODE		
D71			HSM88AS	CHIP DIODE		
D72 -74			RLS73	CHIP DIODE		
D75			1N60PSPA	DIODE		
D76			RLS73	CHIP DIODE		
D77			DAN202(K)	CHIP DIODE		
D78			RLS73	CHIP DIODE		
D79 -81			DAN202(K)	CHIP DIODE		
D82			HSM88AS	CHIP DIODE		
D83			RLS73	CHIP DIODE		
D85			DAN202(K)	CHIP DIODE		
D86 -87			HSM88AS	CHIP DIODE		
D88			RLS73	CHIP DIODE		
D89			DAN202(K)	CHIP DIODE		
D90			1S1555	DIODE		
D91			MTZ9.1JB	ZENER DIODE		
D92			RLS73	CHIP DIODE		
D93			UZ3.0B	ZENER DIODE		
D95			RLS73	CHIP DIODE		
D96			MI204	DIODE		
D97			DAN202(K)	CHIP DIODE		
D98			1N60PSPA	DIODE		
D99 -102			RLS135	CHIP DIODE		
D103-106			RLS135	CHIP DIODE		B
D107			DAN202(K)	CHIP DIODE		
D108			RLS73	CHIP DIODE		

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D109, 110			RLS135	CHIP DIODE		
D111			KB369	VARI-CAP DIODE		
D112-115			RLS73	CHIP DIODE		
D116		*	RLZ3. 6B	CHIP ZENER DIODE		
D117			RLS73	CHIP DIODE		
D118			RLS135	CHIP DIODE		
D119			DAN202(K)	CHIP DIODE		
D120			RLS73	CHIP DIODE		
D122			RLS135	CHIP DIODE		
D123			RLS73	CHIP DIODE		
D124			RLS135	CHIP DIODE		
D125		*	RLZ3. 6B	CHIP ZENER DIODE		
D126			RLS135	CHIP DIODE		
D127			1SS133	DIODE		B
D128			RLS73	CHIP DIODE		
D129			RLS73	CHIP DIODE		B
D501, 502			RLS73	DIODE		A
D503			UZ3. 0B	CHIP ZENER DIODE		A
IC1		*	M54581P	IC		
IC2			M74LS145P	IC(DECIMAL DECODER/DRIVER BCD)		
IC3			AN612	IC(BALANCE MODULATOR)		
IC4			UPC2002V	IC(OP AMP X2)		
IC5			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC6			MC3357P	IC(LOW POWER FM IF)		
IC7 -10			TC4066BP	IC(ANALOG/ DIGITAL SW)		
IC11			LM324N	IC(QUAD OP AMP X4)		
IC12			AN7808	IC(VOLTAGE REGULATOR/ +8V)		
Q1			2SA1162(Y)	CHIP TRANSISTOR		B
Q2			2SA1162(Y)	CHIP TRANSISTOR		B
Q3 ,4			DTC114EK	DIGITAL TRANSISTOR		B
Q5			DTA143EK	DIGITAL TRANSISTOR		B
Q6 -8			DTA143EK	DIGITAL TRANSISTOR		
Q9 -11			2SC2668(Y)	TRANSISTOR		
Q12			2SK192A(GR):KJ	FET		B
Q13			2SC2668(Y)	TRANSISTOR		
Q14			2SC1907	TRANSISTOR		
Q15			2SC2053	TRANSISTOR		
Q16			DTA114EK	DIGITAL TRANSISTOR		
Q17			DTC114EK	DIGITAL TRANSISTOR		
Q18 ,19			2SK125-5	FET		
Q20		*	FMC3	DIGITAL TRANSISTOR		
Q21			3SK122(L)	FET		
Q22 ,23			2SK125-5	FET		
Q27			3SK73(GR)	FET		
Q28			2SA1162(Y)	CHIP TRANSISTOR		
Q29			2SC2712(Y)	CHIP TRANSISTOR		
Q30 ,31			3SK73(GR)	FET		
Q32		*	FMC3	DIGITAL TRANSISTOR		
Q34			DTC114EK	DIGITAL TRANSISTOR		
Q35 -39			DTA143EK	DIGITAL TRANSISTOR		
Q40 -42			2SC2712(Y)	CHIP TRANSISTOR		
Q43 ,44		*	FMC3	DIGITAL TRANSISTOR		
Q45 -54			2SC2712(Y)	CHIP TRANSISTOR		
Q55			DTC114EK	DIGITAL TRANSISTOR		
Q56 -59			2SC2712(Y)	CHIP TRANSISTOR		

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060			2SK192A(Y)	FET		
061			2SA1162(Y)	CHIP TRANSISTOR		
062			DTC114TK	DIGITAL TRANSISTOR		
063			DTC114EK	DIGITAL TRANSISTOR		B
064			DTC114TK	DIGITAL TRANSISTOR		B
065 -67			DTC114EK	DIGITAL TRANSISTOR		
068			2SK192A(Y)	FET		
069			2SA1162(Y)	CHIP TRANSISTOR		
070			2SK125-5	FET		B
071			2SC1907	TRANSISTOR		B
072			2SK125-5	FET		B
073			2SC1907	TRANSISTOR		B
074			2SC2712(Y)	CHIP TRANSISTOR		
075			DTC114EK	DIGITAL TRANSISTOR		
076			D7A143EK	DIGITAL TRANSISTOR		
077			DTC114EK	DIGITAL TRANSISTOR		
078			3SK73(GR)	FET		
079 -80			3SK122(L)	FET		
081			2SC2053	TRANSISTOR		
082		*	FMC3	DIGITAL TRANSISTOR		
083			DTC114EK	DIGITAL TRANSISTOR		B
084			DTC114EK	DIGITAL TRANSISTOR		
085		*	FMC3	DIGITAL TRANSISTOR		B
086			3SK73(GR)	FET		
087			2SA1162(Y)	CHIP TRANSISTOR		
088		*	FMC3	DIGITAL TRANSISTOR		
089			2SC2712(Y)	CHIP TRANSISTOR		
090			2SA1162(Y)	CHIP TRANSISTOR		
091 -92			DTC114EK	DIGITAL TRANSISTOR		
093			DTC114TK	DIGITAL TRANSISTOR		
094 -95			DTC114TK	DIGITAL TRANSISTOR		B
096 -97			DTC114EK	DIGITAL TRANSISTOR		
098			2SC2712(Y)	CHIP TRANSISTOR		
099			DTC114EK	DIGITAL TRANSISTOR		
THJ -4			112-502-2	THERMISTOR		
-			X59-1060-00	SIDE TONE UNIT		
-			X59-1080-00	VXU UNIT		
-		*	X59-3000-02	FM MIC UNIT		A
-		†	X59-3340-00	TRX UNIT		
-		*	X59-3350-00	NB2 UNIT		
-		*	X59-3360-00	DELAY TIME UNIT		
SIDE TONE (X59-1060-00)						
C1			CK73FB1E223K	CHIP C	0.022UF	K
C2 -5			CK73FB1H123K	CHIP C	0.012UF	K
C6 -8			CK73FB1E223K	CHIP C	0.022UF	K
-			E23-0471-05	TERMINAL		
P1 -2			RK73FB2A23J	CHIP R	82K	J 1/10W
R3			RK73FB2A23J	CHIP R	22K	J 1/10W
R4			RK73FB2A472J	CHIP R	4.7K	J 1/10W
R5			RK73FB2A102J	CHIP R	1.0K	J 1/10W
R6			RK73FB2A103J	CHIP R	10K	J 1/10W
R7 -8			RK73FB2A333J	CHIP R	33K	J 1/10W
R9			RK73FB2A103J	CHIP R	10K	J 1/10W

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R10 R11 W1 -6			RK73FB2A333J RK73FB2A183J R92-0670-05	CHIP R 33K J 1/10W CHIP R 18K J 1/10W CHIP R 0 OHM		
D1 D2 D3 Q1			DAN202(K) DAP202(K) DAN202(K) 2SC2712(Y)	CHIP DIODE CHIP DIODE CHIP DIODE CHIP TRANSISTOR		
VOX (X59-1080-00)						
C1 C2 --			CK73FB1H102K CK73FB1E223K E23-0471-05	CHIP C 1000PF K CHIP C 0.022UF K TERMINAL		
R1 R2 -5 R6 .7 R8 R9			RK73FB2A104J RK73FB2A103J RK73FB2A105J RK73FB2A474J RK73FB2A105J	CHIP R 100K J 1/10W CHIP R 10K J 1/10W CHIP R 1.0M J 1/10W CHIP R 470K J 1/10W CHIP R 1.0M J 1/10W		
R10 W1 -3			RK73FB2A103J R92-0670-05	CHIP R 10K J 1/10W CHIP R 0 OHM		
D1 .2 IC1 IC2 Q1			DAP202(K) NJM2904M TC4001BF 2SC2712(Y)	CHIP DIODE IC(OP AMP X2) IC(NOR X6) CHIP TRANSISTOR		
FM MIC AMP. (X59-3000-02)						
C1 C2 C3 C4 C5 --			CC73FCH1H680J CK73FB1H561K CC73FCH1H390J CK73FB1H102K CK73FB1E223K E23-0471-05	CHIP C 68PF J CHIP C 560PF K CHIP C 39PF J CHIP C 1000PF K CHIP C 0.022UF K TERMINAL		
JR1 R1 R2 R3 R4			R92-0670-05 RK73FB2A105J RK73FB2A823J RK73FB2A562J RK73FB2A472J	CHIP R 0 OHM CHIP R 1.0M J 1/10W CHIP R 82K J 1/10W CHIP R 5.6K J 1/10W CHIP R 4.7K J 1/10W		
R5 -7 R8 R9			RK73FB2A224J RK73FB2A182J RK73FB2A104J	CHIP R 220K J 1/10W CHIP R 1.8K J 1/10W CHIP R 100K J 1/10W		
IC1 Q1			NJM4558M 2SC2712(Y)	IC(OP AMP X2) CHIP TRANSISTOR		
TRX (X59-3340-00)						
C1 -3 --			CK73EB1H473K E23-0471-05	CHIP C 0.047UF K TERMINAL		
R1 R2 R3 R4 R5			RK73FB2A103J RK73FB2A471J RK73FB2A103J RK73FB2A471J RK73FB2A103J	CHIP R 10K J 1/10W CHIP R 470 J 1/10W CHIP R 10K J 1/10W CHIP R 470 J 1/10W CHIP R 10K J 1/10W		
R6 W1 .2			RK73FB2A471J R92-0670-05	CHIP R 470 J 1/10W CHIP R 0 OHM		

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D1 .2 Q1 .2 Q3 Q4 .5			DAN202(K) 2SA1204(Y) 2SA1182(Y) DTC114EK	CHIP DIODE CHIP TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR		
NB2 (X59-3350-00)						
C1 C2 C3 - R1 R2 R3 R4 R5 W1 -3 IC1 Q1 .2			CK73FB1H103K CK73FB1H102K CK73EF1E474Z E23-0471-05 RK73FB2A103J RK73FB2A563J RK73FB2A684J RK73FB2A103J RK73FB2A184J R92-0670-05 TC4011BF DTC114EK	CHIP C 0.010UF K CHIP C 1000PF K CHIP C 0.47UF Z TERMINAL CHIP R 10K J 1/10W CHIP R 56K J 1/10W CHIP R 680K J 1/10W CHIP R 10K J 1/10W CHIP R 180K J 1/10W CHIP R 0 OHM IC(NAND X4) DIGITAL TRANSISTOR		
DELAY TIME (X59-3360-00)						
C1 - R1 -3 W1 -7 D1 IC1 Q1 -5 Q6 Q7			CK73FB1H103K E23-0471-05 RK73FB2A103J R92-0670-05 DAN202(K) MB74LS122 DTC114EK DTA114EK DTC114TK	CHIP C 0.010UF K TERMINAL CHIP R 10K J 1/10W CHIP R 0 OHM CHIP DIODE IC DIGITAL TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
FAN (X59-3370-00)						
C1 - R1 R2 R3 R4 R5 R6 R7 R8 R9 .10 W1 .2 IC1 Q1			CK73FB1H103K F23-0471-05 RK73FB2A103J RK73FB2A223J RK73FB2A562J RK73FB2A122J RK73FB2A562J RK73FB2A332J RK73FB2A562J RK73FB2A223J RK73FB2A103J R92-0670-05 NJM4558M 2SC2712(Y)	CHIP C 0.010UF K TERMINAL CHIP R 10K J 1/10W CHIP R 22K J 1/10W CHIP R 5.6K J 1/10W CHIP R 1.2K J 1/10W CHIP R 5.6K J 1/10W CHIP R 3.3K J 1/10W CHIP R 5.6K J 1/10W CHIP R 22K J 1/10W CHIP R 10K J 1/10W CHIP R 0 OHM IC(OP AMP X2) CHIP TRANSISTOR		

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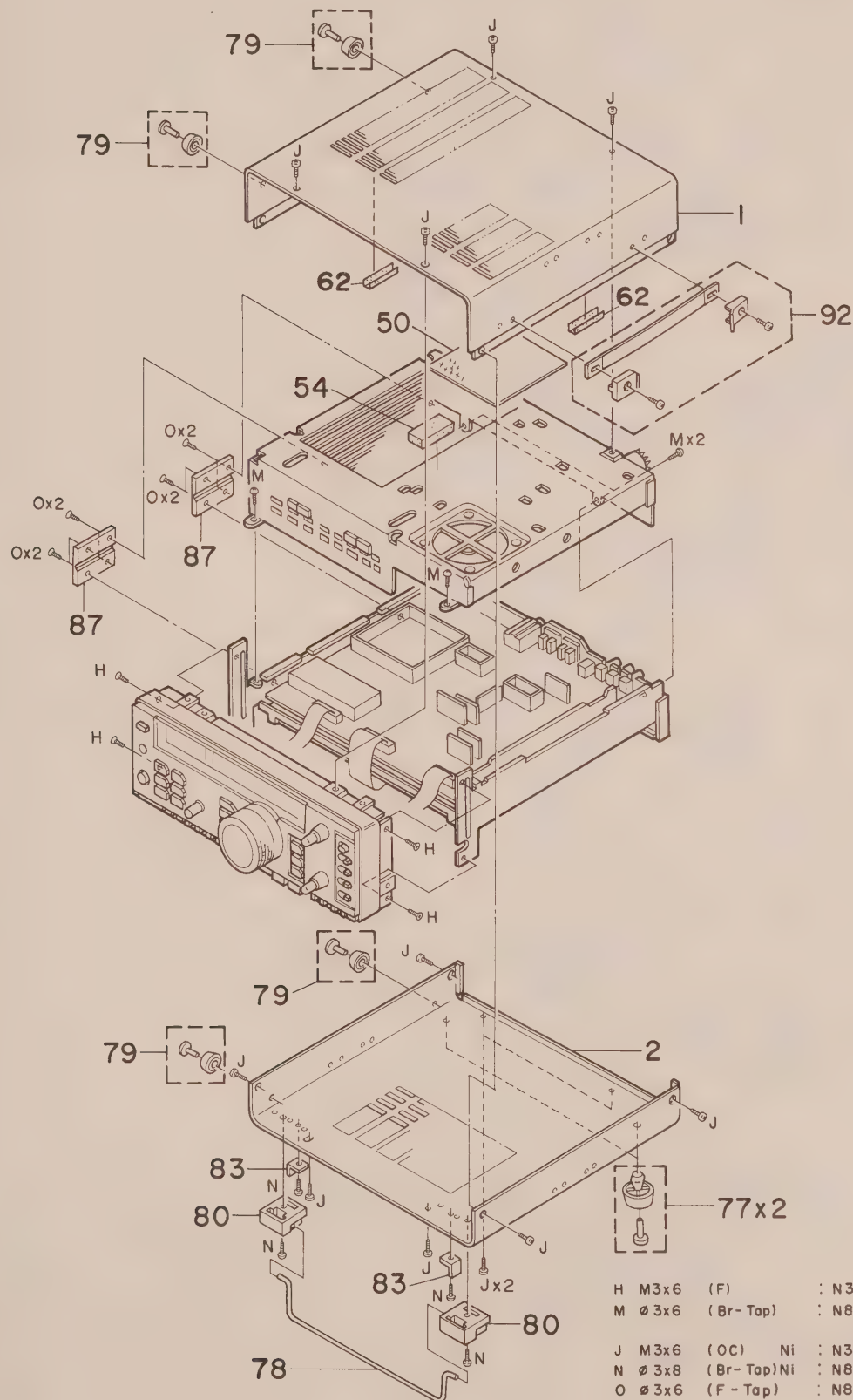
B : TS-680S (K)

UE : AAFES(Europe)

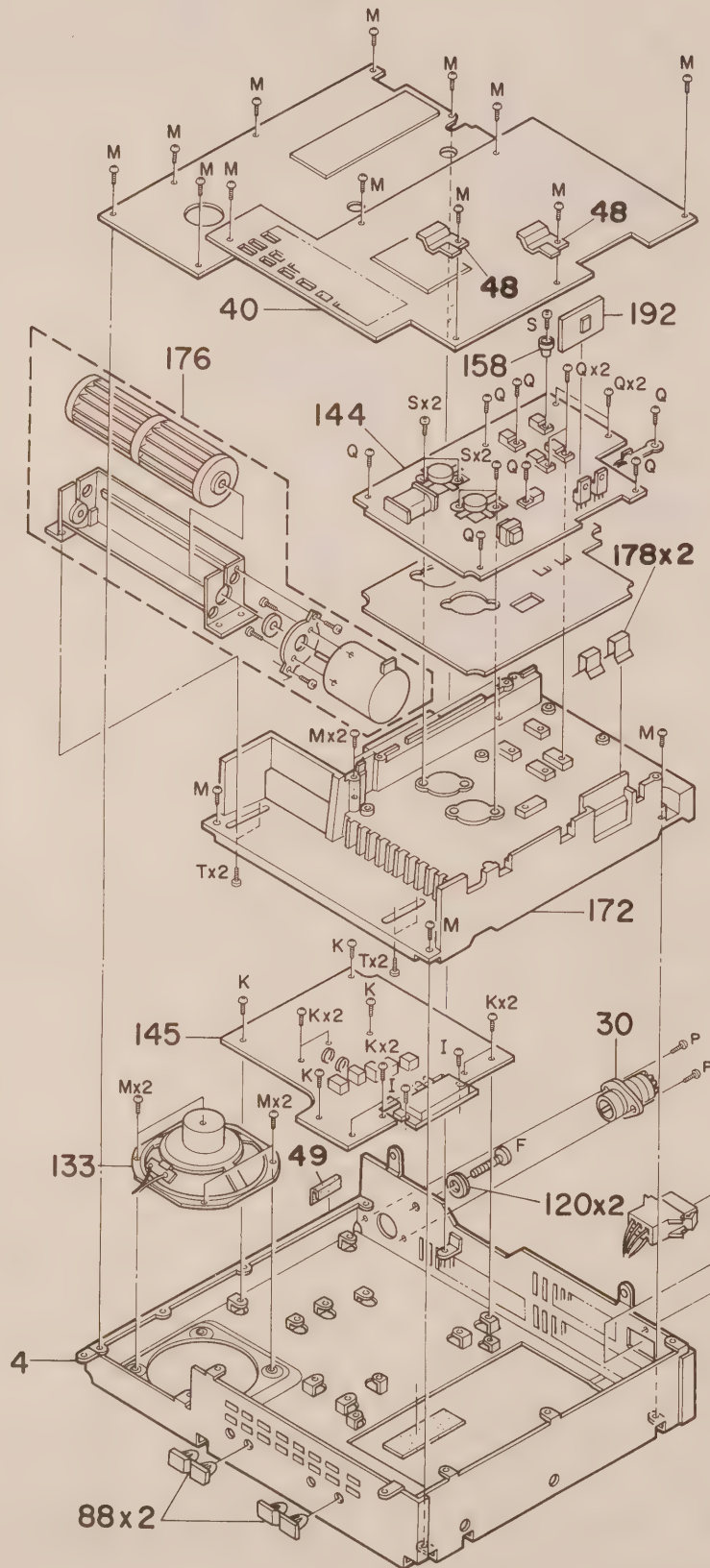
X: Australia

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DISASSEMBLY

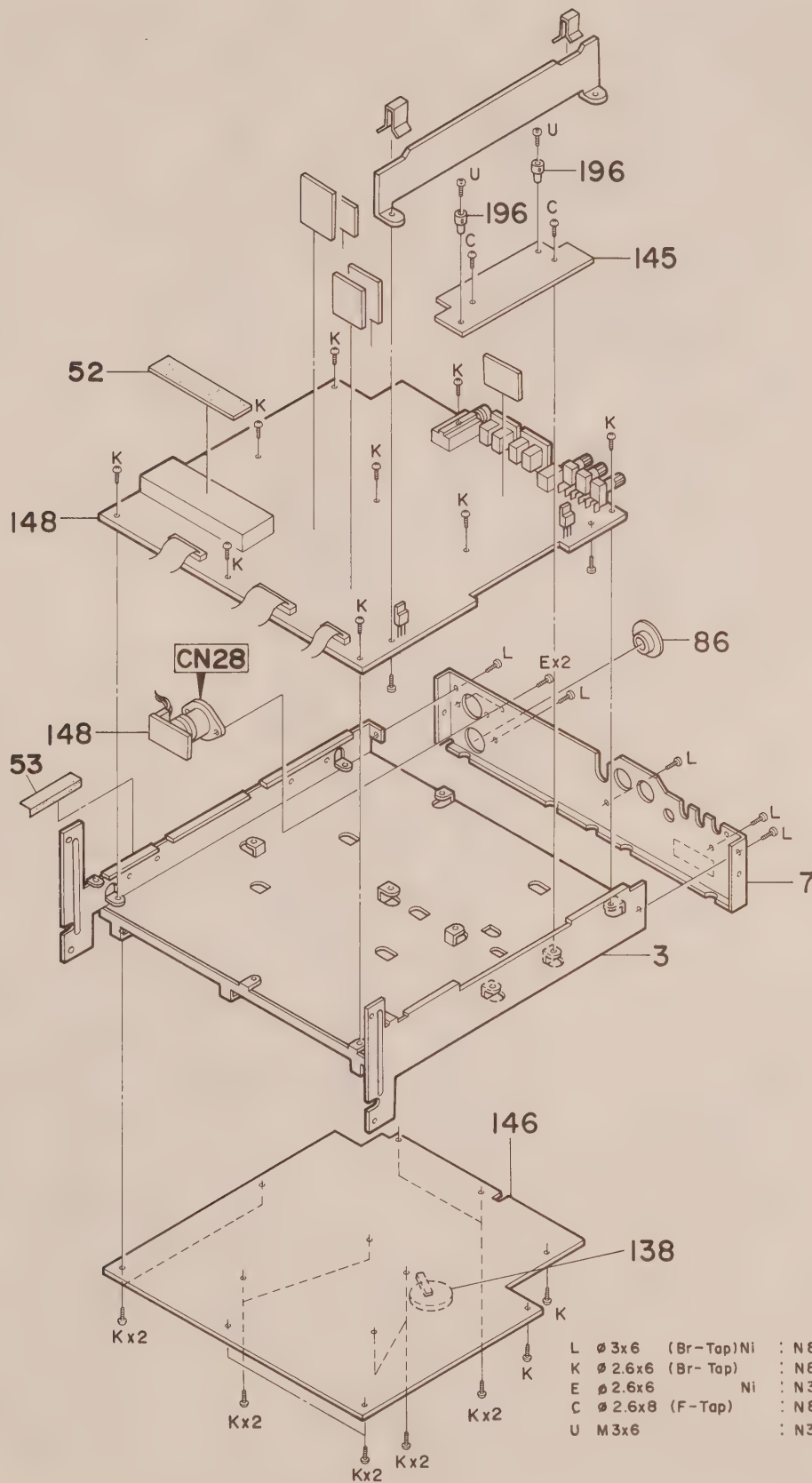


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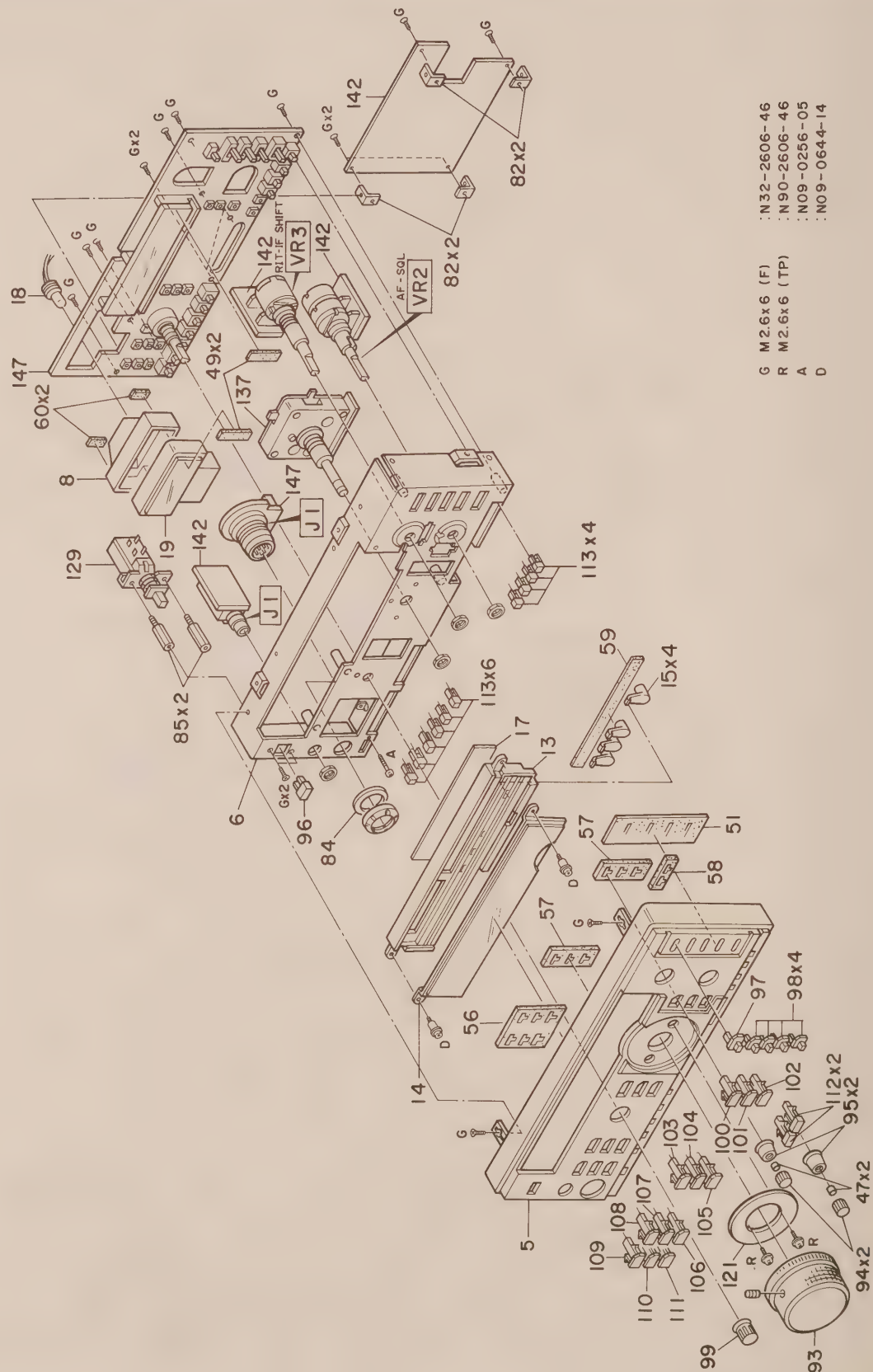


M	Ø3x6 (Br-Tap)	: N87-3006-46
F	M4x14 Ni	: N30-4014-41
B		: N09-0372-04
P	Ø3x10 (Br-Tap)Ni	: N87-3010-41
K	Ø2.6x6 (Br-Tap)	: N87-2606-46
Q	Ø3x8 (Br-Tap)	: N87-3008-46
S		: N09-0623-04
T	M3x6 (Bi)	: N35-3006-46
I		: N09-0623-04

DISASSEMBLY



DISASSEMBLY



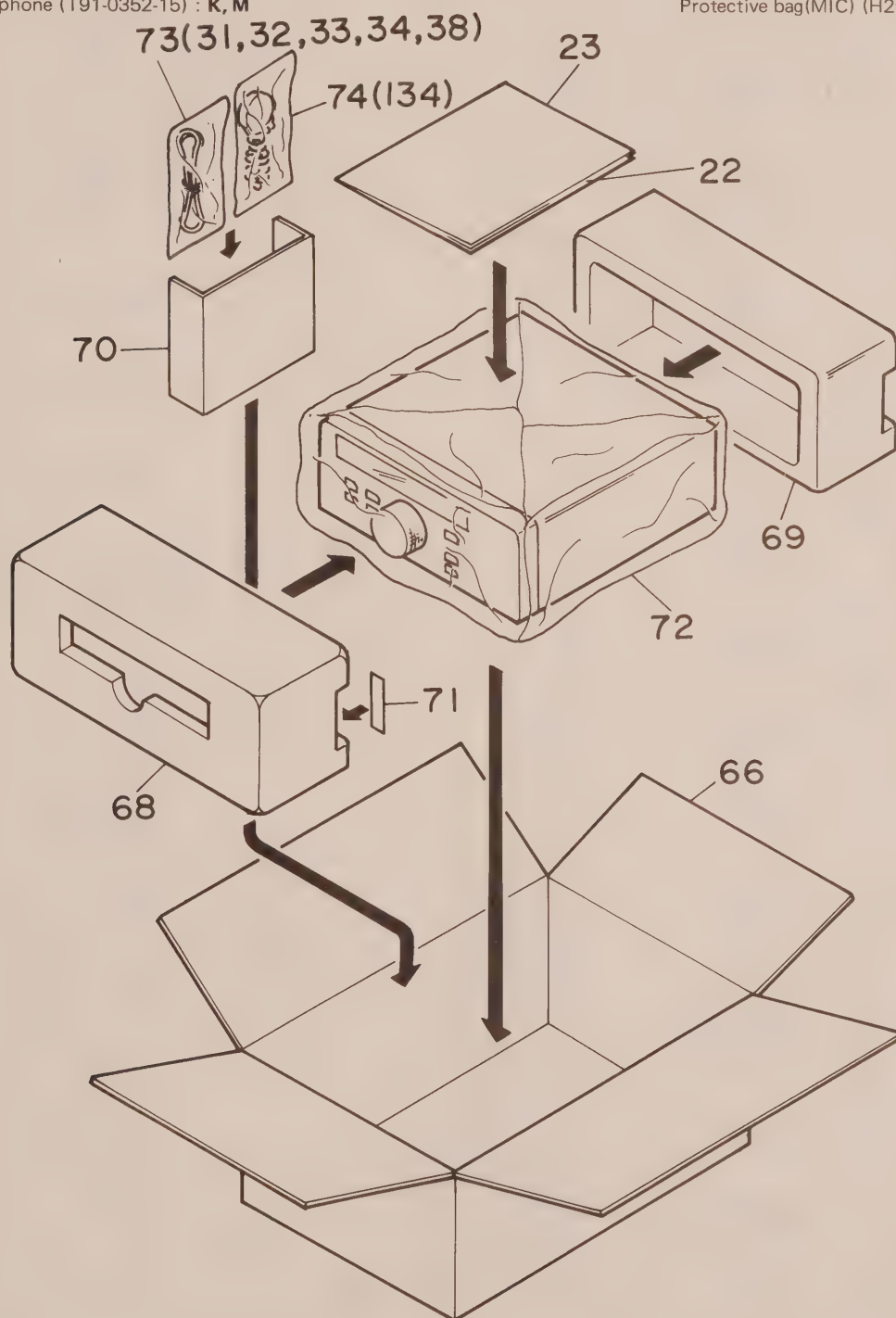
G	M 2.6x6 (F)	: N 32-2606-46
R	M 2.6x6 (TP)	: N 90-2606-46
A		: N 09-0256-05
D		: N 09-0644-14

PACKING

Accessory

Warranty card (B46-0410-20) : **K**
 Instruction manual (B50-8199-20)
 7P DIN plug (E07-0751-05)
 DC power cord ass'y (E30-2065-05)
 Connecting wire(CAL) (E31-2154-05)
 13P plug (E07-1351-05)
 Fuse(20A) (F05-2036-05)
 Microphone (T91-0352-15) : **K, M**

Carton box (H01-8146-04) : **TS-140S**
 Carton box (H01-8165-04) : **TS-680S**
 Packing fixture(FRONT) (H10-2633-02)
 Packing fixture(REAR) (H10-2634-02)
 Cushion (H12-1315-04)
 Cushion(FRONT) (H12-1405-04)
 Protective cover (H20-1410-03)
 Protective bag(DC CORD) (H25-0112-04)
 Protective bag(MIC) (H25-0079-04) : **K, M**



RX SECTION



Input : OdB_{μ}

AF output : $0.63\text{V}/8\Omega$

Note1 : The SSG signal of 14.200MHz/0dBμ is input from the ANT terminal, and the audio output of 0.63V/8Ω is obtained by adjusting the AF GAIN VR.

The SSG signal levels at various points necessary to obtain the same audio output at this time with the AF GAIN VR at a fixed position are plotted here.

Note2 : In FM mode, this signal level is used to obtain the same value as the S/N at time when OdB μ is input.

Note3: The SSG output is measured through a capacitor of $0.01\mu\text{F}$.

Frequency : 14.200MHz

Note1: The high-frequency part is measured with the RF V.M in the CW mode.

The low-frequency part is measured with the AFV.M in the USB mode.

Note2: The audio input voltage in the USB mode is the input for obtaining 1kHz single tone which reads almost the maximum value in the ALC zone, and that in the FM mode is the input for realizing the standard modulation ($\pm 3\text{kHz DEV.}$).

Note3: MIC VR is set to the maximum point.

ADJUSTMENT

REQUIRED TEST EQUIPMENT

1. **DC Voltmeter (DC V.M)**
 - 1) Input resistance : More than $1\text{ M}\Omega$
 - 2) Voltage range : 1.5 to 1000 V AC/DC

NOTE : A high-precision multimeter may be used. However, accurate readings can not be obtained for high-impedance circuits.
2. **DC Ammeter**
 - 1) Current range : 1.5A, 3A, 20A, High-precision ammeter may be used.
3. **RF VTVM (RF V.M)**
 - 1) Input impedance : $1\text{ M}\Omega$ and less than 3 pF , min.
 - 2) Voltage range : 10mV to 300 V
 - 3) Frequency range : 10kHz to 100MHz or greater
4. **AF Voltmeter (AF V.M)**
 - 1) Frequency range : 50Hz to 10kHz
 - 2) Input resistance : $1\text{ M}\Omega$ or greater
 - 3) Voltage range : 10mV to 30 V
5. **AF Generator (AG)**
 - 1) Frequency range : 200Hz to 5kHz
 - 2) Output : 1 mV or less to 1 V, low distortion
6. **AF Dummy Load**
 - 1) Impedance : 8Ω
 - 2) Dissipation : 3W or greater
7. **Oscilloscope (SCOPE)**

Vertical amplifier which has frequency characteristics higher than 100MHz.

Requires high sensitivity, and external synchronization capability.
8. **Tracking generator**
 - 1) Center frequency : 50kHz to 90MHz
 - 2) Frequency deviation : Maximum $\pm 35\text{ MHz}$
 - 3) Output voltage : 0.1 V or greater
 - 4) Sweep rate : At least 0.5sec/cm
9. **Standard Signal Generator (SSG)**
 - 1) Frequency range : 50 kHz to 500MHz
 - 2) Output : $-20\text{ dB}/0.1\mu\text{V}$ to $120\text{ dB}/1\text{ V}$
 - 3) Output impedance : 50Ω
 - 4) AM and FM modulation can be possible.

NOTE : Generator must be frequency stable.
10. **Frequency Counter (FREQ.C)**
 - 1) Minimum input voltage : 50mV
 - 2) Frequency range : 500MHz or greater
 - 3) Output impedance : 50Ω
11. **Noise Generator**

Must generate ignition noise containing harmonics beyond 30MHz.
12. **RF Dummy Load**
 - 1) Impedance : 150Ω
 - 2) Dissipation : 150W or greater
13. **Power Meter**
 - 1) Impedance : 50Ω
 - 2) Dissipation : 150W continuous or greater
 - 3) Frequency limits : 60MHz or greater

14. Spectrum Analyzer (SPE-ANA)

- 1) Frequency range : 100kHz to 500MHz or greater
- 2) Bandwidth : 1 kHz to 3MHz

15. Detector

- 1) For adjustment of PLL/VCO BPF



16. Directional Coupler

17. Power

- PS-430, PS-50 (S Type)
PS-21 (V Type)

18. Microphone

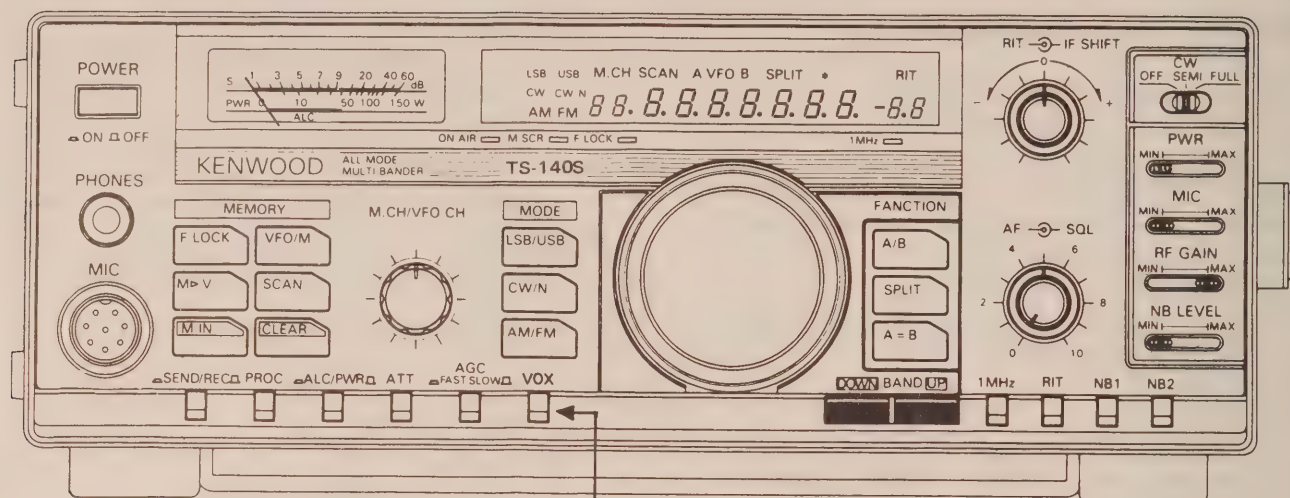
- MC-60S8 or MC-42S

PREPARATION

Unless otherwise specified, set the controls as follows :

POWER.....	ON	PROC	OFF
BAND.....	14	ALC/PWR	PWR
AF	MIN	ATT	OFF
SQL	MIN	AGC.....	SLOW
IF SHIFT	CENTER	VOX (TS-140S)	OFF
CW.....	OFF	RF AMP (TS-680S) ...	OFF
PWR	MIN	1MHz.....	OFF
MIC	MIN	RIT.....	OFF
RF GAIN.....	MAX	NB1	OFF
NB LEVEL	MIN	NB2	OFF
F. LOCK	OFF	VFO A/B	A
SEND/REC.....	REC	SPLIT.....	OFF

ADJUSTMENT



TS-680S : RF AMP

RESET

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reset	1) Set the power SW ON, while depressing the A=B key.							A VFO 14.000.0 MODE : USB

VOLTAGE CHECK

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Voltage		DC V.M	Signal	⑧-4			13.8V	13.1 ~ 14.3V
				8V(Silk)			7.7V	7.2 ~ 8.0V
				TXB(Silk)			7.5V	7.0 ~ 8.0V
				RXB(Silk)			7.5V	7.0 ~ 8.0V
				FMB(Silk)				6.5 ~ 8.0V
				AMB(Silk)				6.5 ~ 8.0V
				CWN(Silk)				6.5 ~ 8.0V
				CWB(Silk)				6.5 ~ 8.0V
				SSB(Silk)				6.5 ~ 8.0V
			Ctrl	⑫-1		5V		4.5 ~ 5.5V
2. RFG voltage	1) RF GAIN VR : MAX		Signal	RXB (Silk)	Signal	VR22	3.1V	3.05 ~ 3.15V

ADJUSTMENT

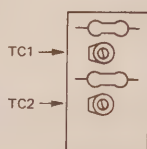
PLL ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reference frequency	1)	f. counter	Ctrl	TP5 (R77)	Ctrl	TC1	36.000000MHz	± 10Hz
2. VCO-4	1)	DC V.M		TP8 (L53)		L54	5.0V	4.8 ~ 5.2V
3. VCO-3	1) FREQ. : 14.000.00 MODE : AM			TP1 (L2)		L3	2.4V	2.3 ~ 2.5V
	2) FREQ. : 14.000.00 MODE : USB IF SHIFT VR : Center Control unit VR4 : CW MAX	f. counter		①-1		VR2	455.700kHz	± 5Hz
	3) IF SHIFT VR : CW MAX						Check	457.250kHz or more.
	4) IF SHIFT VR : CCW MAX							454.125kHz or less.
	5) IF SHIFT VR : Center Control unit VR4 : Center							
4. VCO-2	1) FREQ. : 13.999.90 MODE : AM	DC V.M		TP2 (L11)		L12	1.2V	1.1 ~ 1.3V
	2) FREQ. : 14.000.00 MODE : AM						Check	3.1 ~ 3.7V
5. VCO-2 BPF	1) FREQ. : 14.025.00 MODE : AM	Oscilloscope		TP3 (R51)		L17~ L19	Repeat 2 ~ 3 times. Level MAX.	1.4V/p-p or more. (Ref. level : 1.75V/p-p)
				TP4 (W2)		L28, L29		0.3V/p-p or more. (Ref. level : 0.4V/p-p)
				TP6 (R100)		L30~ L32		120mV/p-p or more. (Ref. level : 150mV/p-p)
	2) FREQ. : 10.025.00 MODE : AM					L32, L42~ L44		80mV/p-p or more. (Ref. level : 100mV/p-p)
	3) FREQ. : 24.525.00 MODE : AM					L39~ L41		
6. VCO-1	1) FREQ. : 59.999.90 MODE : AM TS-680S only.	DC V.M	Signal	⑥-2	Signal	L74	2.0V	1.9 ~ 2.1V
	2) FREQ. : 45.000.00 MODE : AM TS-680S only.						Check	5.0 ~ 6.0V
	3) FREQ. : 34.999.90 MODE : AM					L72	6.0V	5.9 ~ 6.1V
	4) FREQ. : 21.500.00 MODE : AM						Check	2.0 ~ 3.0V
	5) FREQ. : 21.499.90 MODE : AM					L70	2.0V	1.9 ~ 2.1V
	6) FREQ. : 10.500.00 MODE : AM						Check	5.0 ~ 6.0V
	7) FREQ. : 10.499.90 MODE : AM					L68	2.0V	1.9 ~ 2.1V
	8) FREQ. : 50.00						Check	5.5 ~ 6.5V


ADJUSTMENT

RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. RX AMP.	1) FREQ. : 14.175.00 MODE : USB SSG output : Optional output from 10dBμ to -6dBμ	SSG AF V.M Oscilloscope 8Ω dummy load		EXT.SP	Signal	L52~ L55, L57,59 L60,64 L65,89	Adjust from L52 to L89.	MAX. AF output.
	2) SSG output : -6dBμ					L52~ L55	Repeat 2 ~ 3 times.	MAX. AF output.
2. FM AMP.	1) FREQ. : 28.800.00 MODE : FM SSG output : 30dBμ (MOD : 1kHz, DEV : ±3kHz)					L86	MAX. AF output.	No distortion in AF waveform.
3. 1st MIX balance	1) FREQ. : 100.00 MODE : USB SSG output : OFF					VR1	MIN. AF noise output.	
4. 2nd MIX balance	1) FREQ. : 14.175.00 MODE : USB SSG output : OFF					VR2	MAX. AF noise output.	
5-1. IF trap	1) FREQ. : 29MHz MODE : USB SSG output : 60dBμ~80dBμ SSG FREQ. : 40.055MHz					L1,46	1) MIN. AF output at 60dBμ of SSG output. 2) Readjust to MIN. AF output at 80dBμ of SSG output.	50dB or more.
5-2. IF trap TS-140S W type only	1) FREQ. : 11.800.00 MODE : USB SSG output : 0dB					TC2	MIN. AF output.	
	2) FREQ. : 15.200.00					TC1	MIN. AF output. Repeat 2 ~ 3 times.	
6. RF AMP. TS-680S only.	1) FREQ. : 28.800.00 MODE : USB SSG output : -10dBμ RF AMP SW : ON					L37	MAX. AF output.	
	2) FREQ. : 50.500.00					L42		
	3) RF AMP SW : OFF							
7. S-meter	1) FREQ. : 14.175.00 MODE : USB AGC SW : FAST							
	• φ point SSG output : OFF					VR26	Set to starting point, (Meter zero)	
	• S1 SSG output : 6dBμ					VR3	S-meter "1".	
	• S9 SSG output : 32dBμ					VR10	S-meter "9".	
	• S1 check SSG output : 6dBμ						Check	6dBμ ± 3dBμ
	• VHF S-meter (TS-680S only) FREQ. : 50.500.00 MODE : USB SSG output : 32dBμ					VR11	S-meter "9".	
	• FM meter FREQ. : 28.800.00 MODE : FM SSG output : 30dBμ (MOD : OFF) RF AMP SW : OFF (TS-680S only)					VR12	S-meter "9 + 20".	

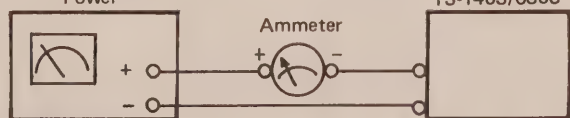


ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
8. RIT	1) Set the Power SW ON, while depressing the CLEAR key.			Display			Check	Display of 10Hz is displayed.
	2) FREQ. : 14.000.00 MODE : USB RIT VR : Center RIT SW : ON				Ctrl	VR1	Set display to MAIN 14.000.00 RIT 0.0	
	3) RIT VR : CW MAX						Check	Display MAIN : 14.001.27 or more RIT : 1.2 or more.
	4) RIT VR : CCW MAX						Check	Display MAIN : 13.998.72 or less. RIT : - 1.2 or less.
	5) RIT VR : Center RIT SW : OFF							
9. NB	1) FREQ. : 14.200.00 MODE : USB SSG output : 30dBμ NB1 SW : ON	SSG DC V.M	Signal		Signal	L84,85	MIN. voltage.	
	2) Connect the noise generator to the ANT terminal.	Noise generator		S- meter			Check	The same effect as NB1 is obtained.
	3) NB1 SW : OFF NB2 SW : ON							
	4) Disconnect the noise generator from the ANT terminal. NB2 SW : OFF							

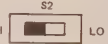
TX ADJUSTMENT

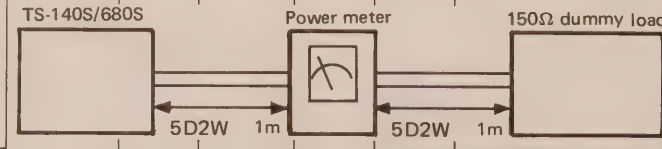
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. TX AMP	1) FREQ. : 50.200.00 (TS-680S) FREQ. : 21.200.00 (TS-140S) MODE : CW Signal unit VR19 : Center CW SW : FULL SEND/REC SW : SEND	Spectrum analyzer	Signal	DRV	Signal	L89,95 L113 VR20	Adjust CAR VR to level no to be saturated, and MAX. output.	MAX. output. (Ref. level : 13dBm or more)
	2) SEND/REC SW : REC							
2. 455kHz spurious	1) FREQ. : 50.200.00 (TS-680S) FREQ. : 21.200.00 (TS-140S) SEND/REC SW : SEND					L53	MIN. Spurious level of 455kHz.	
	2) After adjustment, reconnected DRV. SEND/REC SW : REC							
3. Base current	1) FREQ. : 14.200.00 MODE : USB MIC VR : MIN PWR VR : MIN Final unit VR1, 2 : CCW MAX SEND/REC SW : SEND Power	Ammeter		DC cord	Final	VR1	1) Record current before adjusting VR1 and VR2. 2) Adjust VR1 for an increase for +250mA.	250mA \pm 50mA. (Total current : 1.7 ~ 1.8A)
	2) SEND/REC SW : REC					VR2	Adjust VR2 so that the current is increase of above item 2) 250mA.	500mA \pm 50mA. (Total current : 1.95 ~ 2.05A)



TS-140S/680S

ADJUSTMENT

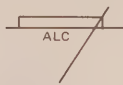
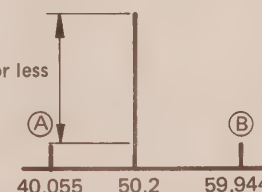
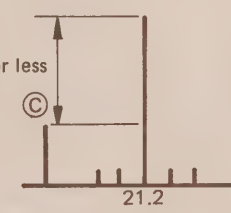
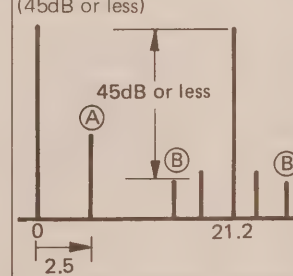
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
4. Power	<ul style="list-style-type: none"> • CW 1) FREQ. : 14.200.00 MODE : CW PWR VR : MAX  S2 Signal unit S2 : HI SEND/REC SW : SEND 	Power meter	Rear	ANT	Signal	VR17	95W	± 5W
	2) SEND/REC SW : REC							
	<ul style="list-style-type: none"> • FM 3) FREQ. : 29.700.00 MODE : FM Filter unit VR1 : Center PWR VR : MAX Signal unit S2 : HI SEND/REC SW : SEND 					VR14	50W	
	4) SEND/REC SW : REC							
	<ul style="list-style-type: none"> • SSB 5) FREQ. : 14.200.00 MODE : USB PWR VR : MAX MIC VR : Center Display unit VR5 : CCW MAX MIC input : 1kHz, 5mV SEND/REC SW : SEND 					VR13	100W	± 5W
	6) SEND/REC SW : REC							
	<ul style="list-style-type: none"> • 50MHz (TS-680S only) 7) FREQ. : 51.200.00 MODE : CW PWR VR : Center Signal unit VR15 : CW MAX SEND/REC SW : SEND 				Filter	TC1	Adjust PWR VR to set output about 10W. MAX. output at TC1.	
	8) PWR VR : MAX				Signal	VR15	11W	± 0.5W
	9) SEND/REC SW : REC							
	<ul style="list-style-type: none"> • MIN. POWER 10) FREQ. : 51.200.00 (TS-680S) FREQ. : 29.700.00 (TS-140S) MODE : FM PWR VR : MIN SEND/REC SW : SEND 					VR18	1W (TS-680S) 5W (TS-140S)	
	11) SEND/REC SW : REC PWR VR : MAX							
5. NULL	1) FREQ. : 3.700.00 MODE : CW SEND/REC SW : SEND	Power meter DC V.M	Signal	VSR (13)-2)	Filter	TC2	MIN	
	2) SEND/REC SW : REC							
6. Protection	1) FREQ. : 14.200.00 MODE : CW SEND/REC SW : SEND	Power meter 150Ω dummy load	Rear	ANT	Signal	VR16	30W	
	2) SEND/REC SW : REC							



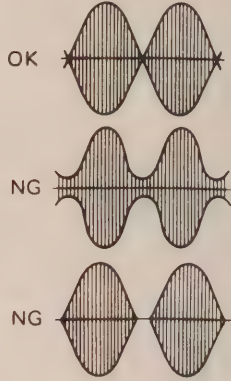
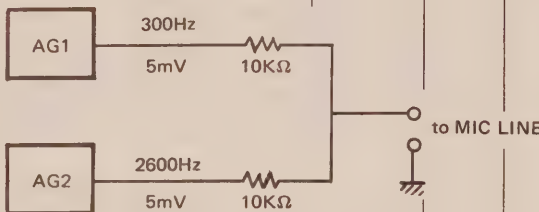
TS-140S/680S Power meter 150Ω dummy load

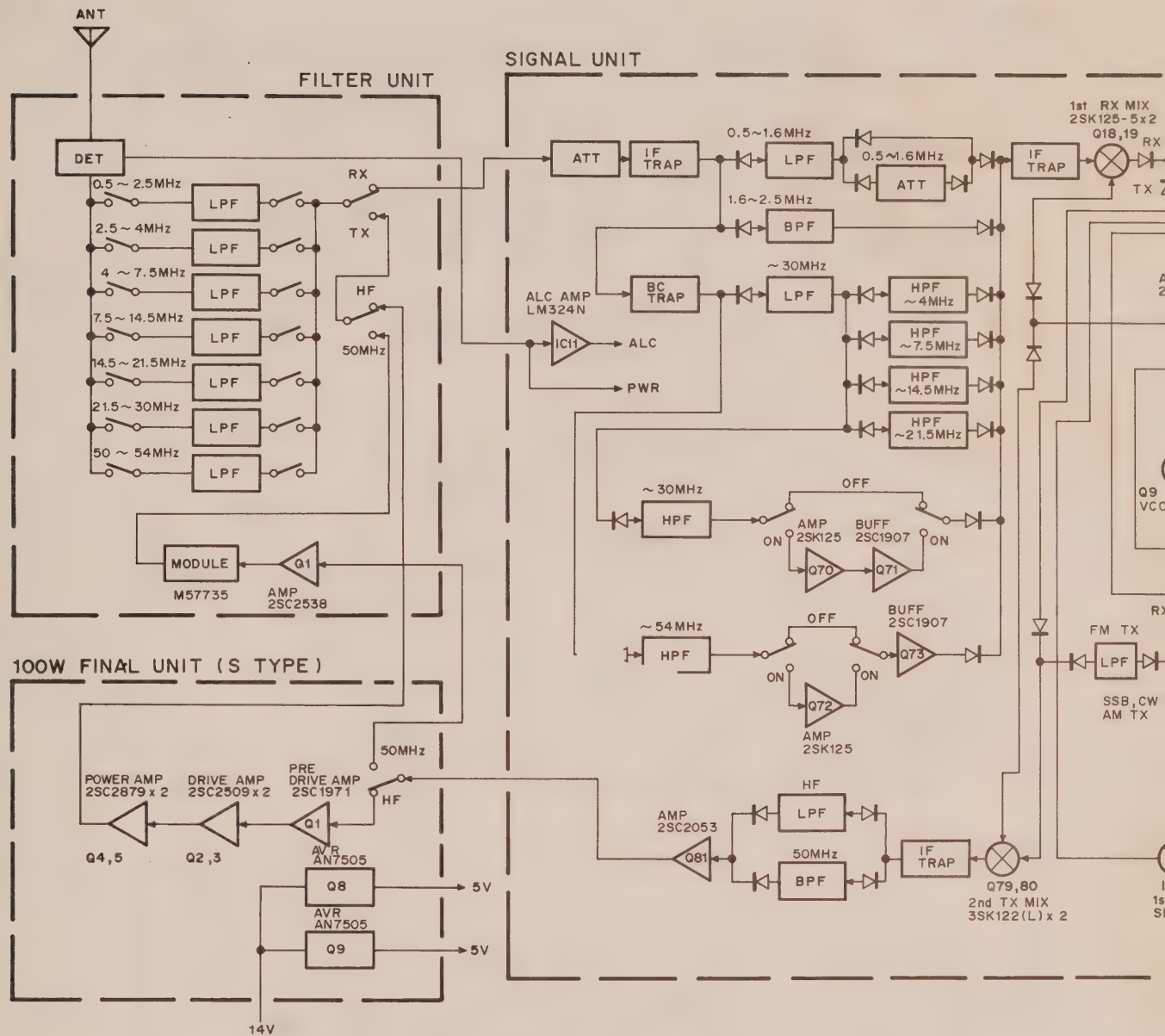
5D2W 1m 5D2W 1m

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
7. Power meter	1) FREQ. : 14.200.00 MODE : CW ALC/PWR SW : PWR SEND/REC SW : SEND	Power meter	Rear	ANT	Signal	VR25	Adjust to 90W by CAR VR.	RF meter : 90W
	2) SEND/REC SW : REC							
8. ALC meter	1) FREQ. : 14.200.00 MODE : USB PWR VR : MAX MIC VR : MAX ALC/PWR SW : ALC Filter unit VR5 : Center	Power meter AG AF V.M		ALC meter	Signal			
	• ϕ point 2) SEND/REC SW : SEND					VR8	Adjust to the "0" of ALC meter reading.	
	3) SEND/REC SW : REC							
	• Start point 4) MIC input : 1kHz, 1.5mV SEND/REC SW : SEND						Adjust to the "0" of ALC meter reading by MIC VR.	
	5) SEND/REC SW : REC							
	• MAX 6) MIC input : 1kHz, 3mV SEND/REC SW : SEND					VR9	Adjust ALC meter MAX. within ALC zone.	
	7) ALC/PWR SW : PWR SEND/REC SW : REC							
9-1. Spurious TS-680S only.	• 50MHz 1) FREQ. : 50.200.00 MODE : CW PWR VR : MAX SEND/REC SW : SEND	Power meter Spectrum analyzer	Rear	ANT	Signal	VR19	Adjust as shown at right. (MIN. spurious of A and B.)	(60dB or less) 
	2) SEND/REC SW : REC							
	• 21MHz 3) FREQ. : 21.200.00 SEND/REC SW : SEND					L97	Adjust as shown at right. (MIN. spurious of C.)	(45dB or less) 
	2) SEND/REC SW : REC							
9-2. Spurious TS-140S only.	1) FREQ. : 21.200.00 MODE : CW PWR VR : MAX SEND/REC SW : SEND					VR19 L97	1) Adjust L97 to MIN. spurious of A. 2) Adjust VR19 to MIN. spurious of B.	(45dB or less) 
	2) SEND/REC SW : REC							




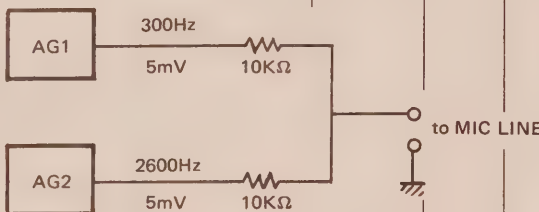
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
10. CAR suppression	1) FREQ. : 14.200.00 MODE : USB or LSB MIC VR : MIN SEND/REC SW : SEND	Power meter Oscilloscope or Spectrum analyzer	Rear	ANT	Signal	VR4 VR5	MIN. Adjust for no difference between USB and LSB.	-40dB or less.
	2) SEND/REC SW : REC							
11. TX frequency response	1) FREQ. : 14.200.00 MODE : USB or LSB AG output : 2 tone, 5mV 300Hz, 2600Hz SEND/REC SW : SEND MIC VR : ALC meter "0"	Power meter Oscilloscope or Spectrum analyzer AG			Ctrl	VR3 (LSB) VR4 (USB)	Adjust as shown at right.	
								
	2) SEND/REC SW : REC							
12. Processor	1) FREQ. : 14.200.00 MODE : USB PROC SW : ON ALC/PWR SW : ALC AG output : 1kHz, 10mV SEND/REC SW : SEND	Power meter AG AF V.M					Adjust for ALC zone MAX. with MIC GAIN VR.	
	2) AG output : 20dB down						Check	
	3) SEND/REC SW : REC							
13. FM DEV	1) FREQ. : 28.700.00 MODE : FM MIC input : 1kHz, 30mV SEND/REC SW : SEND	Power meter AG AF V.M Linear detector			Signal	VR24	4.6kHz	±0.1kHz
	2) MIC input : 1kHz, 3mV					VR6	3kHz	±0.1kHz
	3) SEND/REC SW : REC							
14. Side tone monitor level	1) FREQ. : 14.200.00 MODE : CW AF VR : Center Signal unit VR7 : CW MAX CW SW : SEMI Connect the KEY to the KEY jack.	Power meter AF V.M Oscilloscope 8Ω dummy load		EXT.SP		VR21	0.25V/8Ω	±0.05V
	2) Disconnect the KEY from the KEY jack. CW SW : OFF							
15. Beep sound	1) Depress the LSB/USB key continuously.					VR23	Check	200 ~ 400mV.



CONTROL UNIT

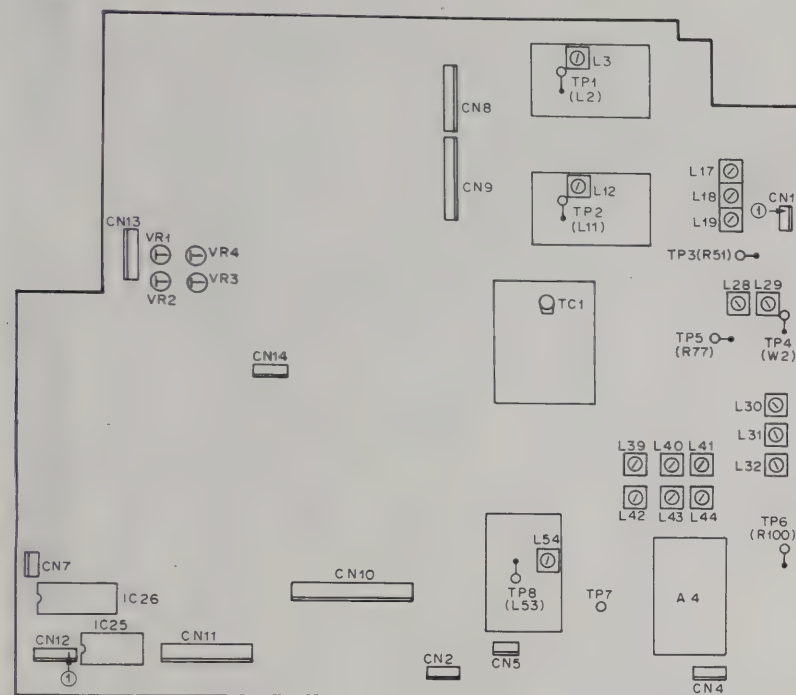
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
10. CAR suppression	1) FREQ. : 14.200.00 MODE : USB or LSB MIC VR : MIN SEND/REC SW : SEND	Power meter Oscilloscope or Spectrum analyzer	Rear	ANT	Signal	VR4 VR5	MIN. Adjust for no difference between USB and LSB.	-40dB or less.
	2) SEND/REC SW : REC							
11. TX frequency response	1) FREQ. : 14.200.00 MODE : USB or LSB AG output : 2 tone, 5mV 300Hz, 2600Hz SEND/REC SW : SEND MIC VR : ALC meter "0"	Power meter Oscilloscope or Spectrum analyzer AG			Ctrl	VR3 (LSB) VR4 (USB)	Adjust as shown at right.	<div>OK </div> <div>NG </div> <div>NG </div>
	<div>  </div>							
	2) SEND/REC SW : REC							
12. Processor	1) FREQ. : 14.200.00 MODE : USB PROC SW : ON ALC/PWR SW : ALC AG output : 1kHz, 10mV SEND/REC SW : SEND	Power meter AG AF V.M					Adjust for ALC zone MAX. with MIC GAIN VR.	
	2) AG output : 20dB down						Check	
	3) SEND/REC SW : REC							
13. FM DEV	1) FREQ. : 28.700.00 MODE : FM MIC input : 1kHz, 30mV SEND/REC SW : SEND	Power meter AG AF V.M Linear detector			Signal	VR24	4.6kHz	±0.1kHz
	2) MIC input : 1kHz, 3mV					VR6	3kHz	±0.1kHz
	3) SEND/REC SW : REC							
14. Side tone monitor level	1) FREQ. : 14.200.00 MODE : CW AF VR : Center Signal unit VR7 : CW MAX CW SW : SEMI Connect the KEY to the KEY jack.	Power meter AF V.M Oscilloscope 8Ω dummy load		EXT.SP		VR21	0.25V/8Ω	±0.05V
	2) Disconnect the KEY from the KEY jack. CW SW : OFF							
15. Beep sound	1) Depress the LSB/USB key continuously.					VR23	Check	200 ~ 400mV.

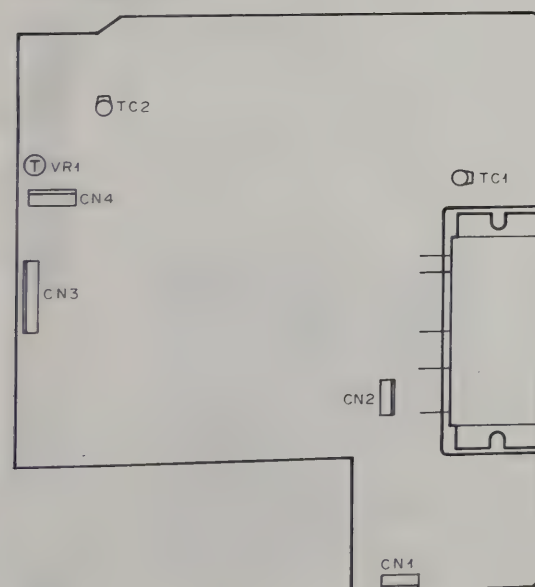
ADJUSTMENT

ADJUSTMENT POINT
(Bottom view)

• CONTROL UNIT

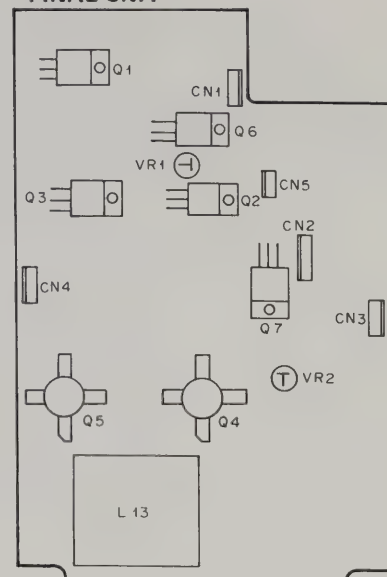


• FILTER UNIT

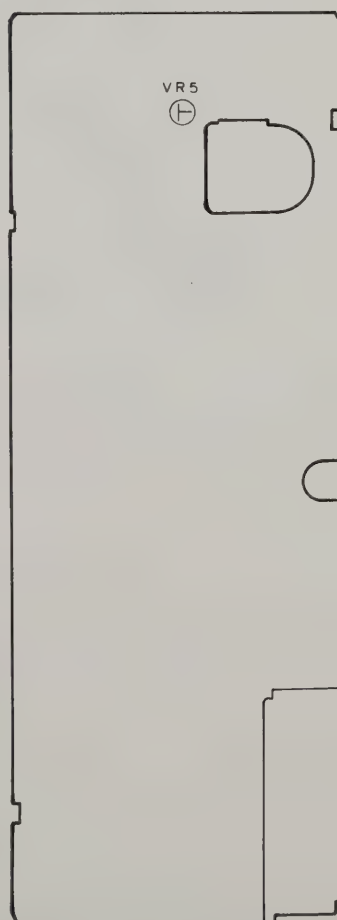


(Top view)

• FINAL UNIT

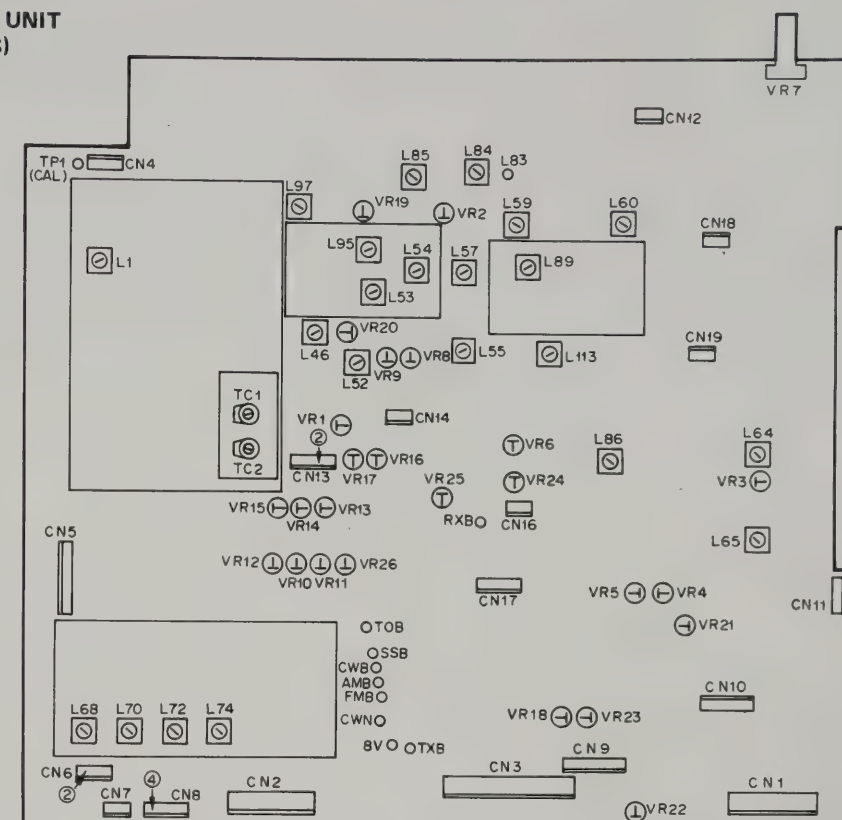


• DISPLAY UNIT

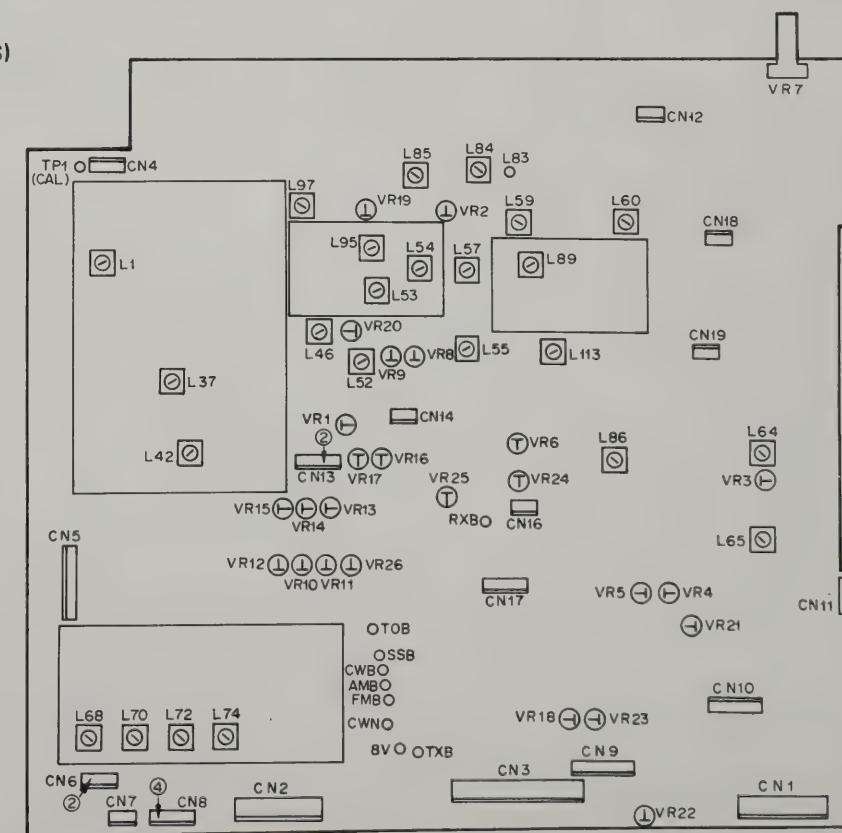


ADJUSTMENT

• SIGNAL UNIT
(TS-140S)

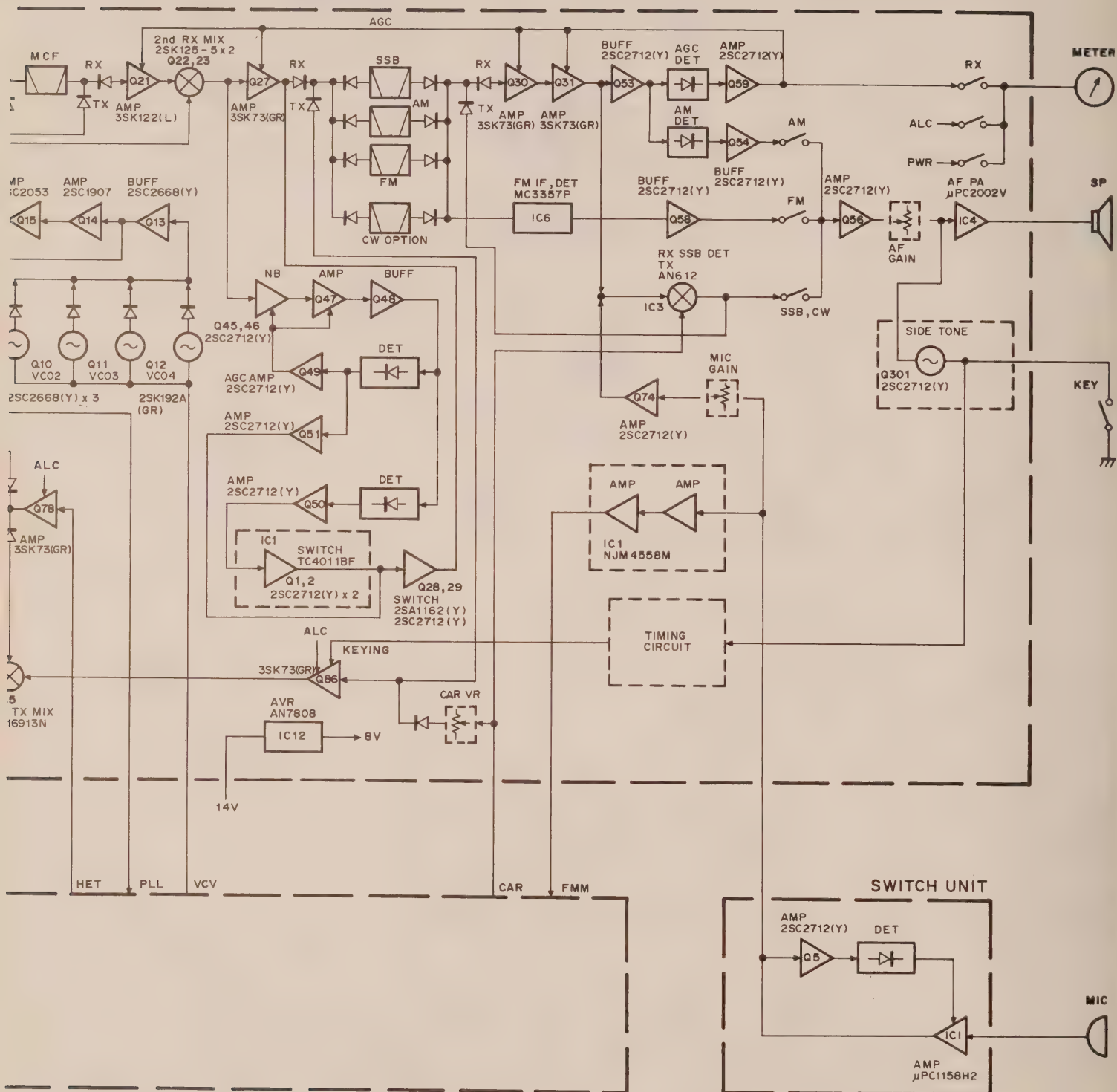


(TS-680S)



TS-140S/680S

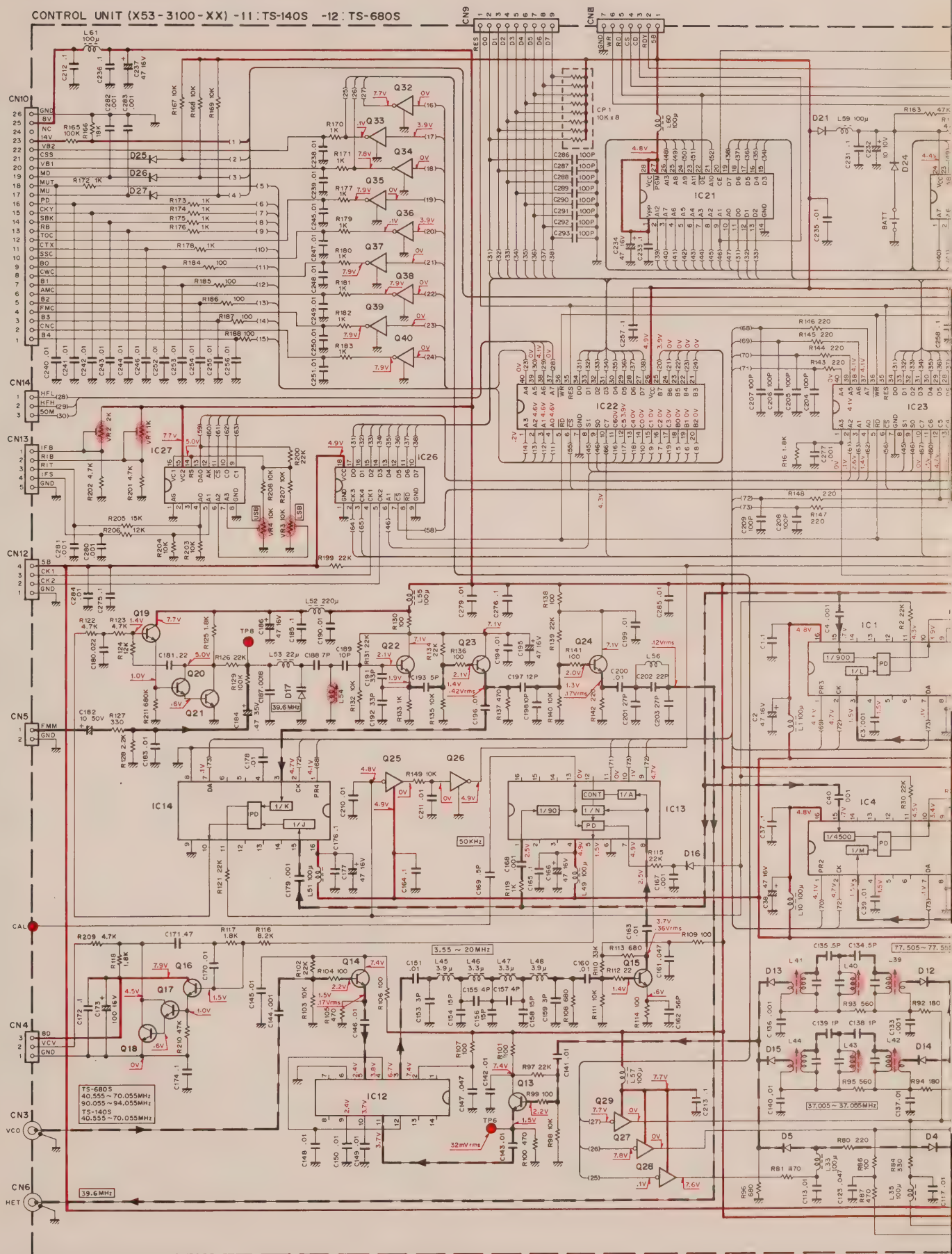
RAM (TS-680S)



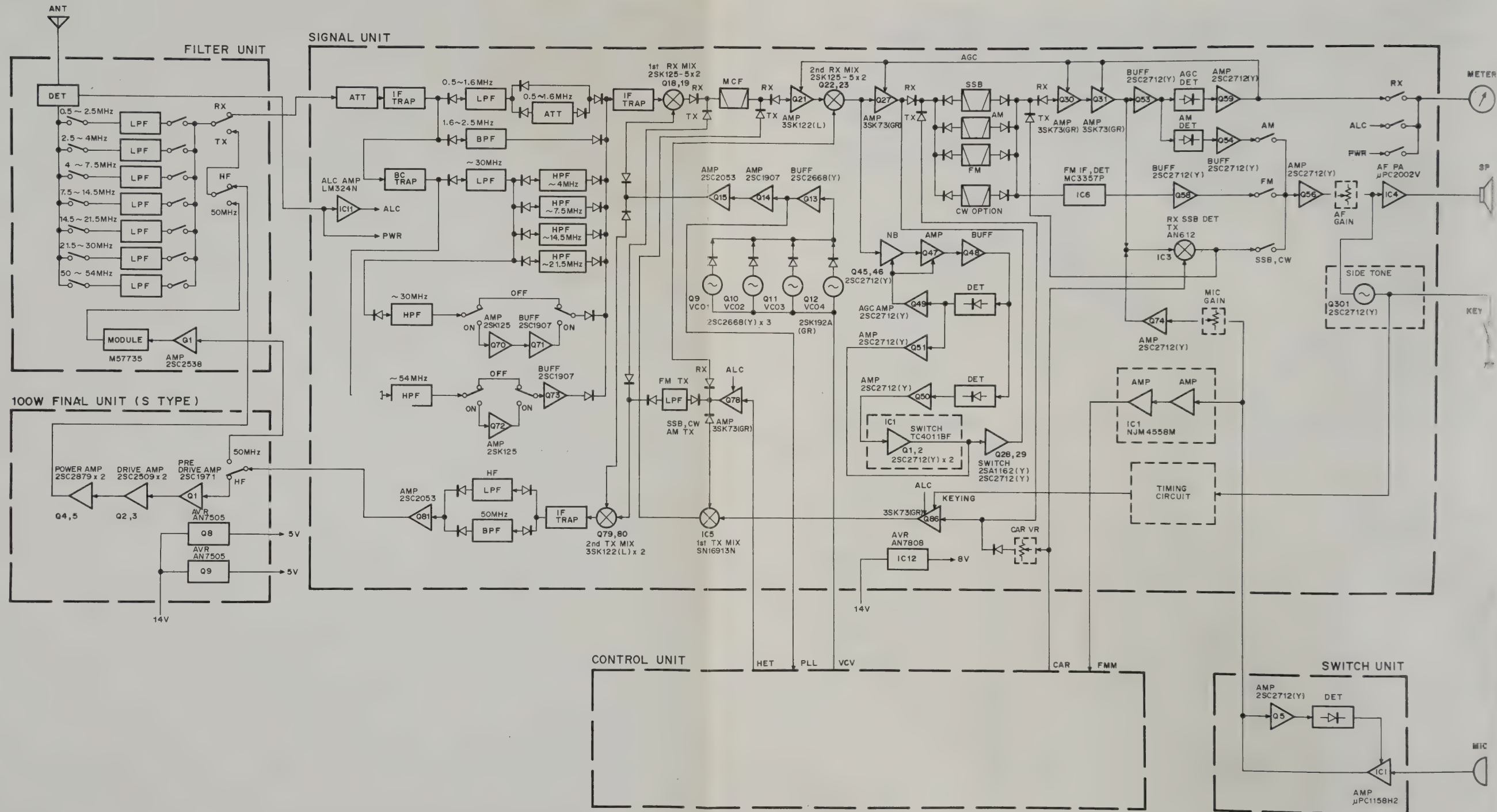
TS-140S/680S CIRCUIT DIAGRAM

CONTROL UNIT (X53-3100-XX)

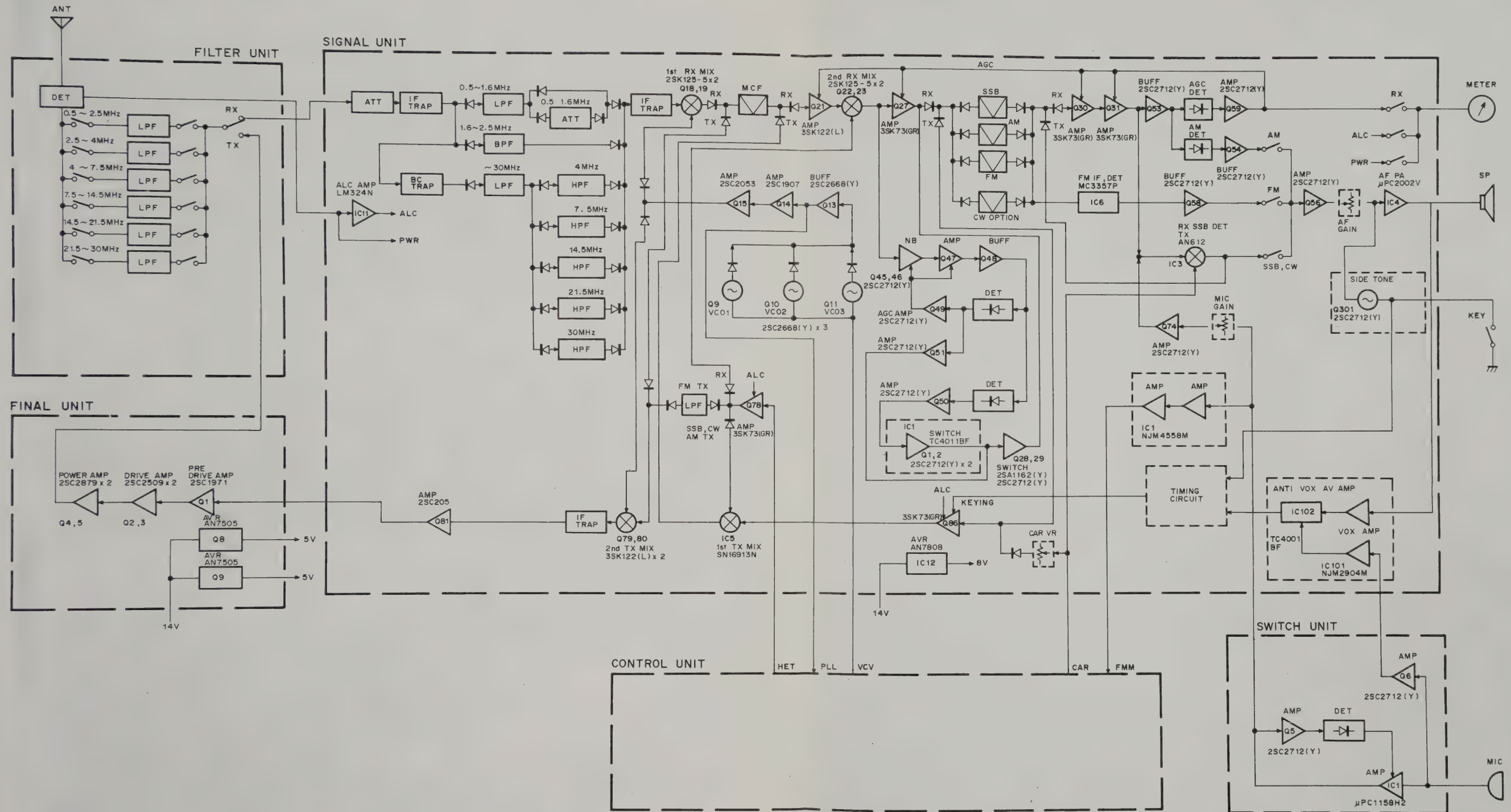
CONTROL UNIT (X53-3100-XX) -11: TS-140S -12: TS-680S



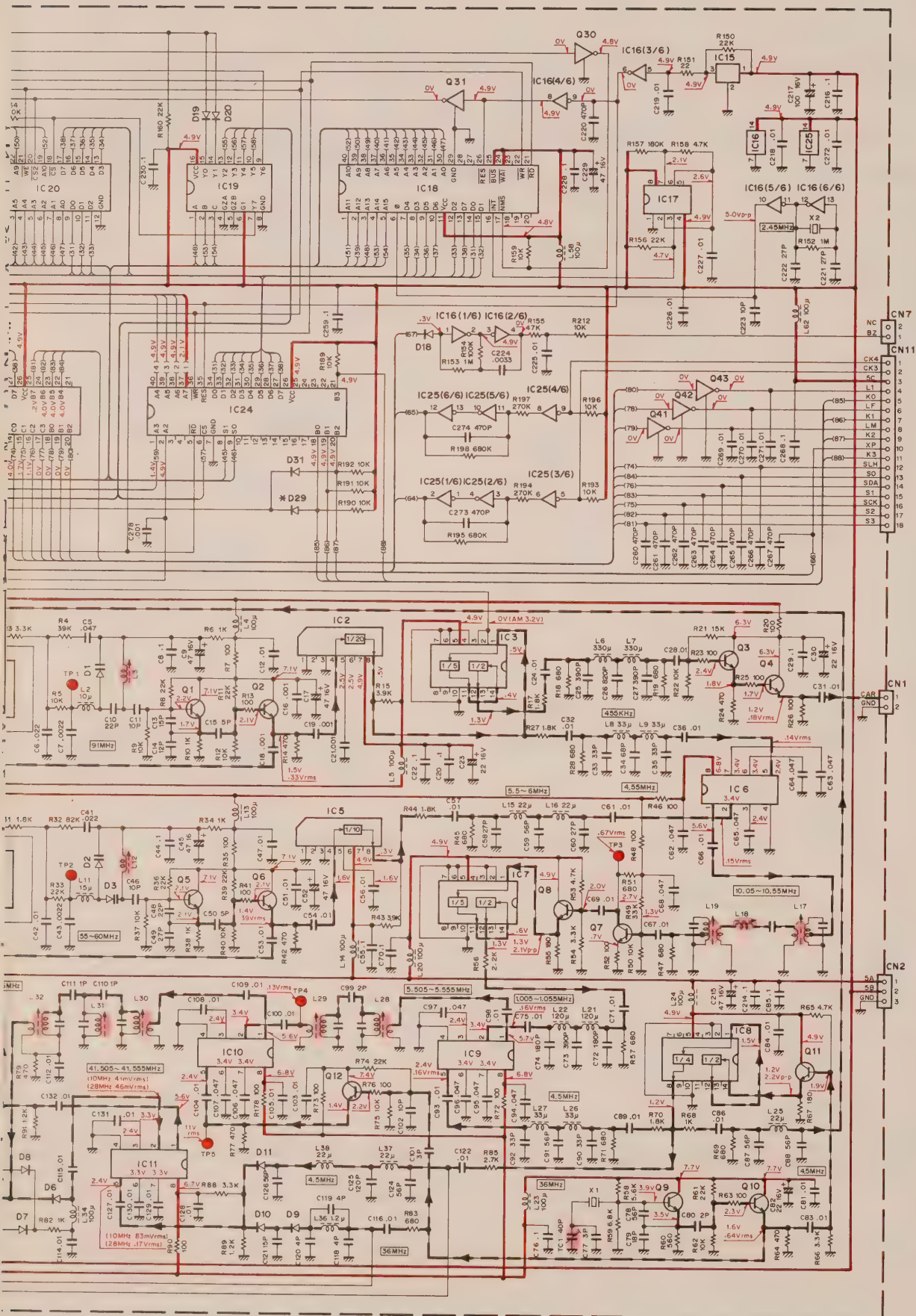
BLOCK DIAGRAM (TS-680S)



BLOCK DIAGRAM (TS-140S)



Voltage measurement condition $f = 14\text{MHz}$, Mode : USB. () : TX.

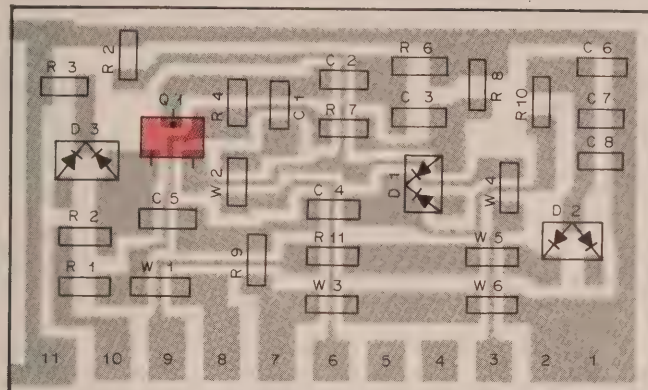


- D1 : 1SV53A
D2,3 : ITT310TE
D4 ~ 6 : RLS135
D7,8,16 : RLS73
18 ~ 21 : ITT310TE
24 ~ 27 : RLS135
D17 : 1SV153
D29,31 : 1SS133
(D29: TS-140S ONLY)
IC1,4,14 : M54927P
IC2 : M54459L
IC3,7 : SN74LS90N
IC5 : M54460L
IC6,9,10,11 : SN16913P
IC8 : M74LS93P
IC12 : SN76514N
IC13 : MB87006A
IC15 : PST5200
IC16,25 : TC4069UBP
IC17 : NE555C
IC18 : BU18400A
IC19 : SN74LS138N
IC20 : TC5518CPL-20
IC21 : MBM27C128-25JAJ2
IC22 ~ 24 : TMP8255AP-5
IC26 : LZ92K37
IC27 : MB4052
Q1,2,5,6 : 2SC2668(Y)
10 ~ 15 : 2SC2668(Y)
22 ~ 24 : 2SC2668(Y)
Q3,7,8 : 2SC2458(Y)
Q4 : 2SC1959(Y)
Q9 : 2SC2787(L)
Q16 ~ 21 : 2SC2459(BL)
Q25 : DTA124ES
Q26 : DTA124ES
Q27 ~ 29 : DTA143ES
Q30 ~ 40 : DTC144WS
Q41 ~ 43 : DTC143TS

TS-140S/680S PC BOARD VIEWS (TS-680S)

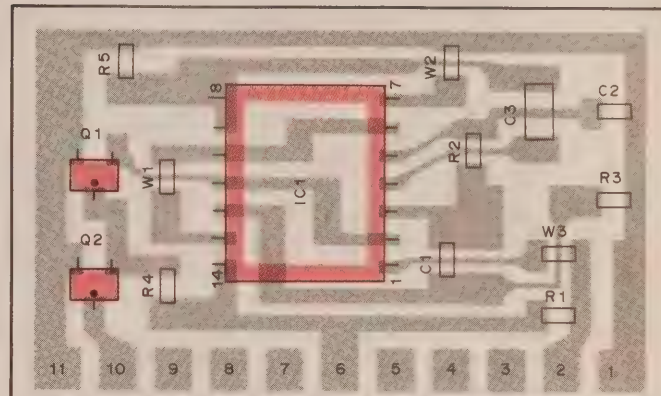
SIDE TONE (X59-1060-00)

Component side view



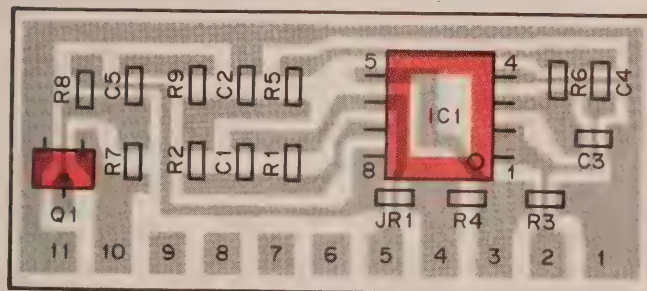
NB2 (X59-3350-00)

Component side view



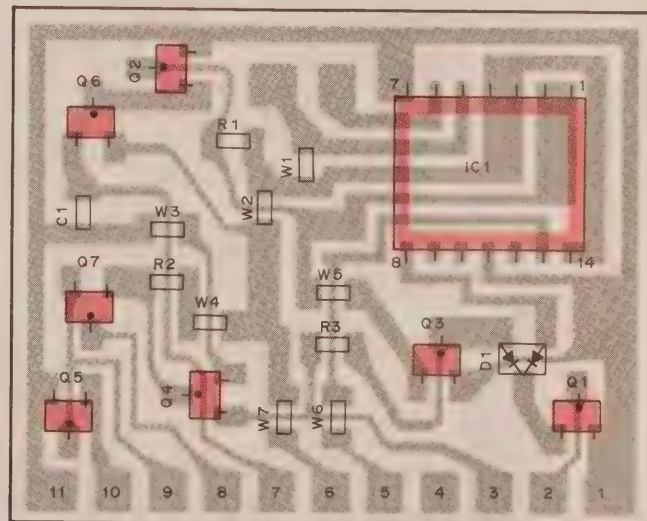
FM MIC AMP. (X59-3000-02)

Component side view



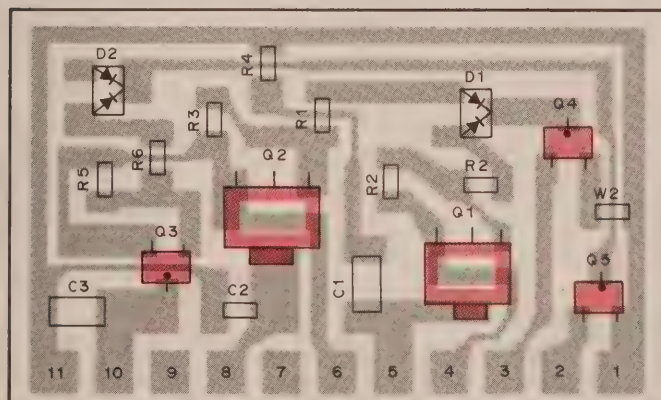
DELAY TIME (X59-3360-00)

Component side view



TRX (X59-3340-00)

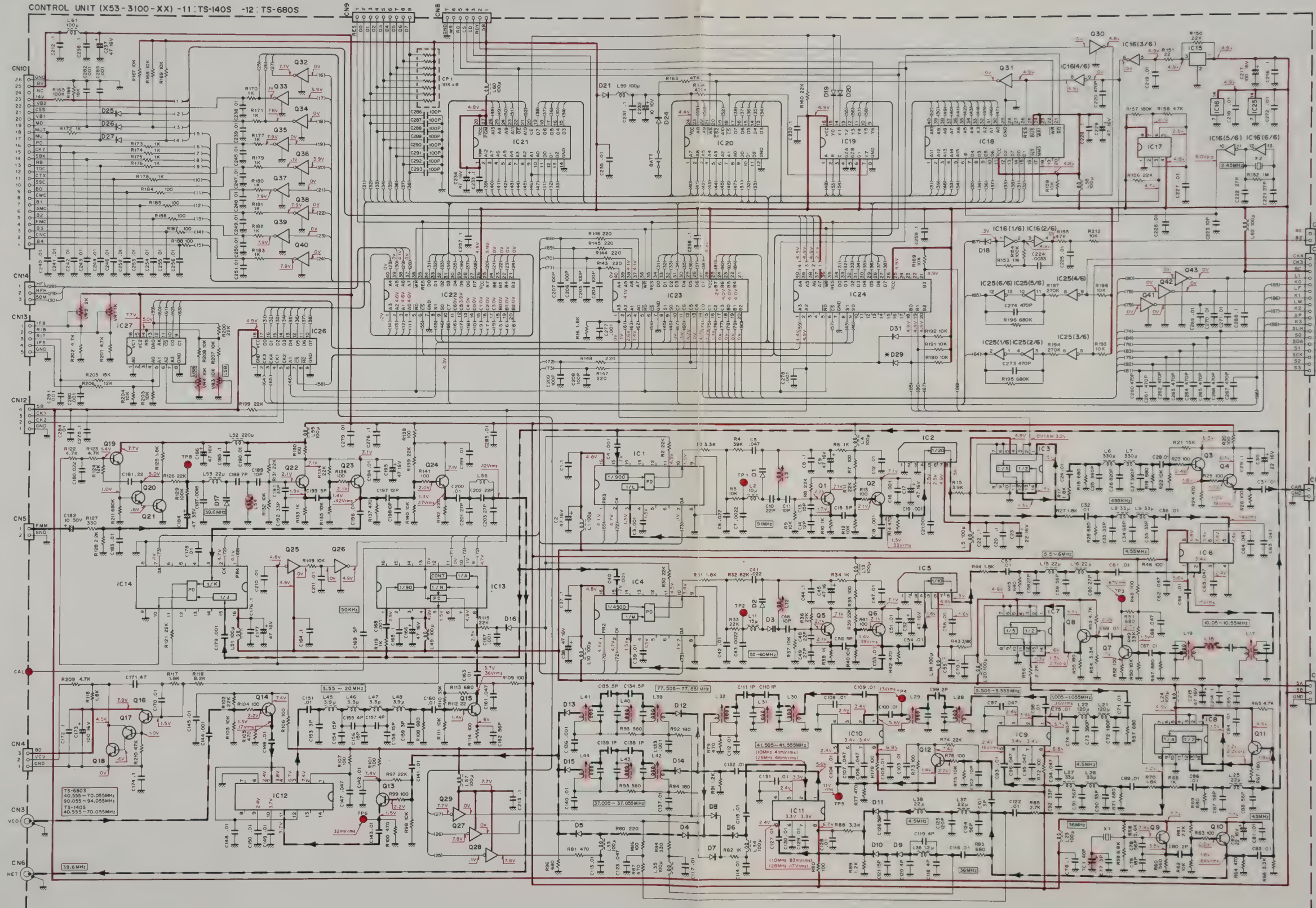
Component side view



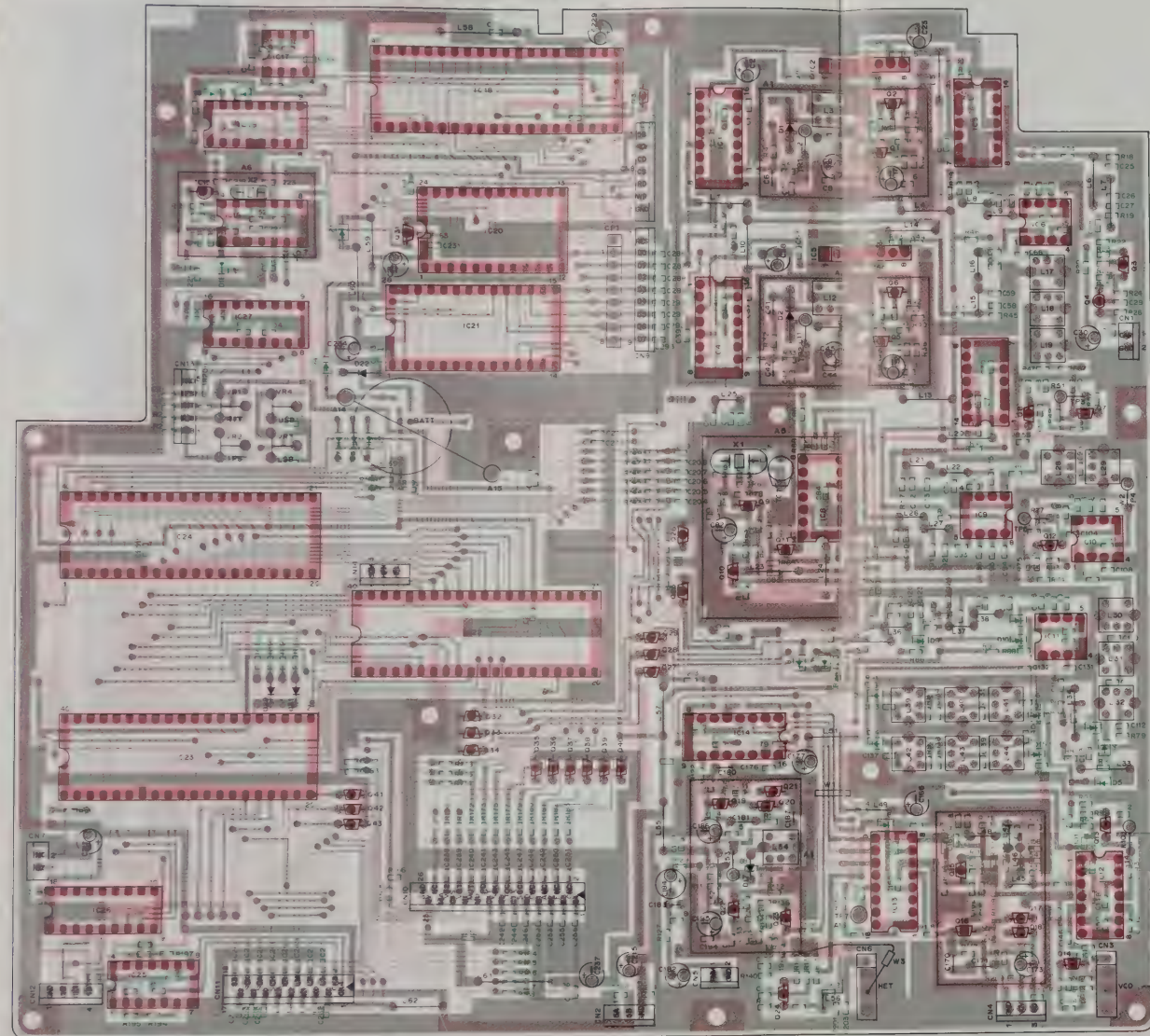
TS-140S/680S CIRCUIT DIAGRAM

CONTROL UNIT (X53-3100-XX)

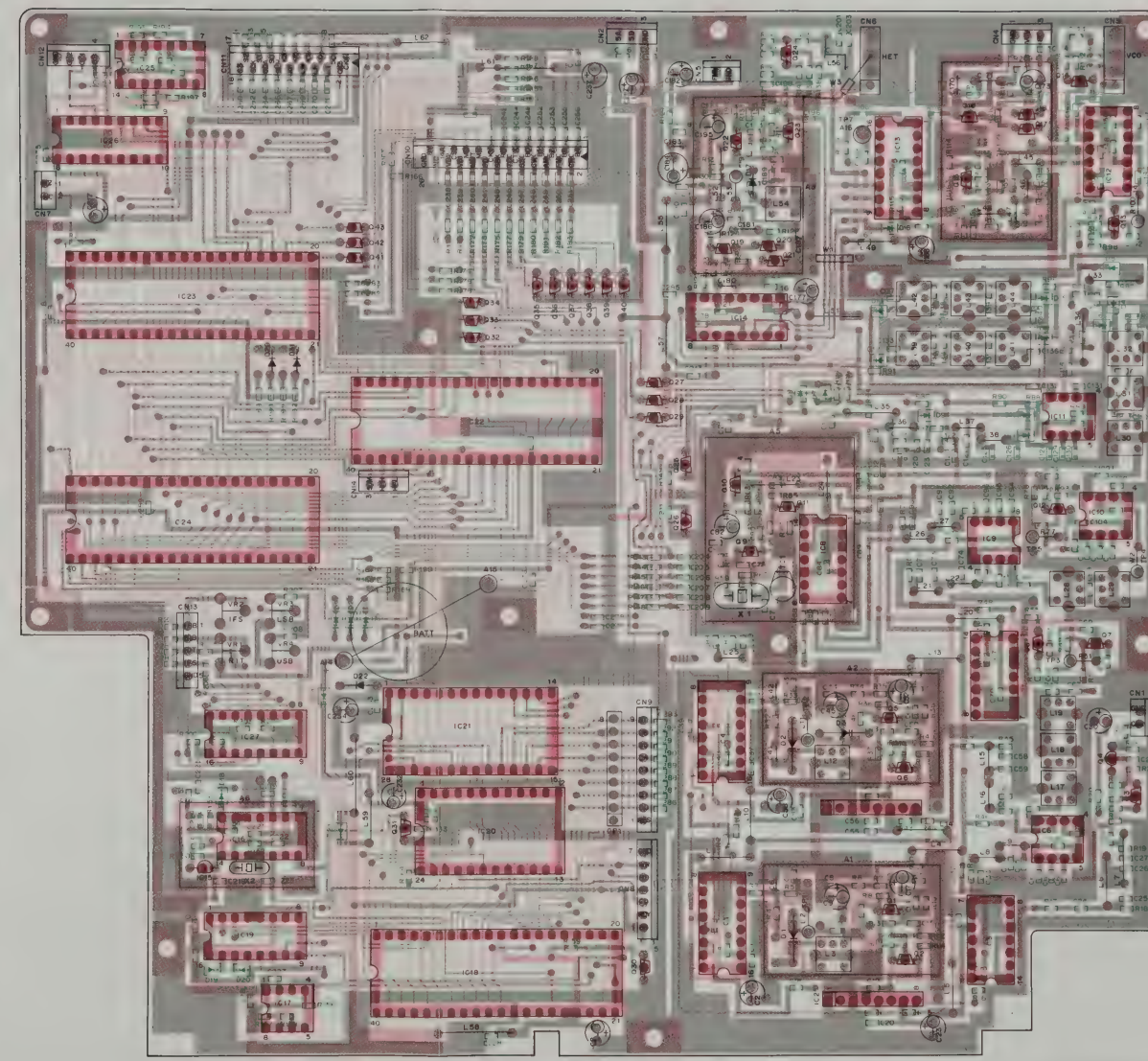
Voltage measurement condition f = 14MHz, Mode : USB. () : TX.



CONTROL UNIT (X53-3100-XX) -11: TS-140S -12: TS-680S Component side view

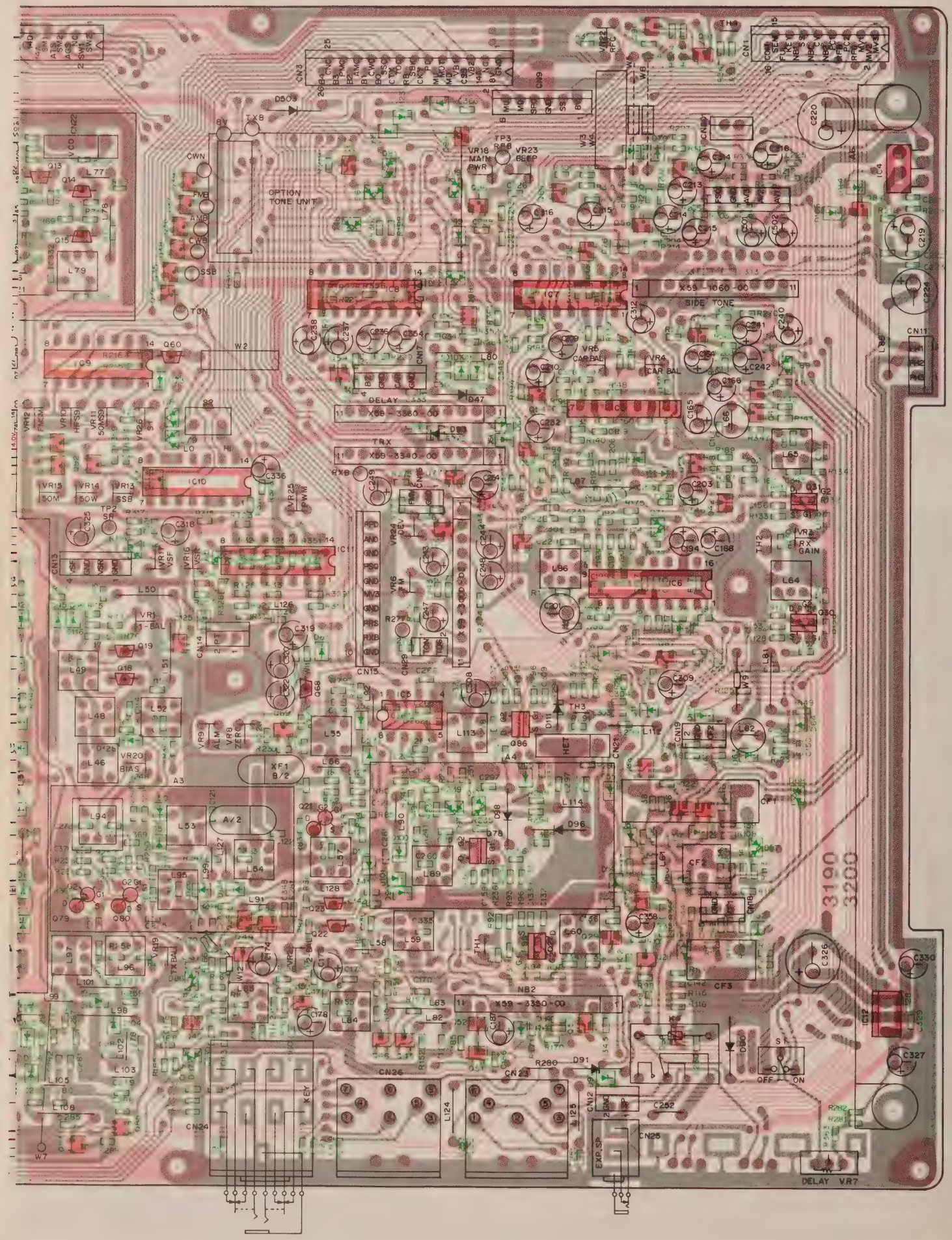


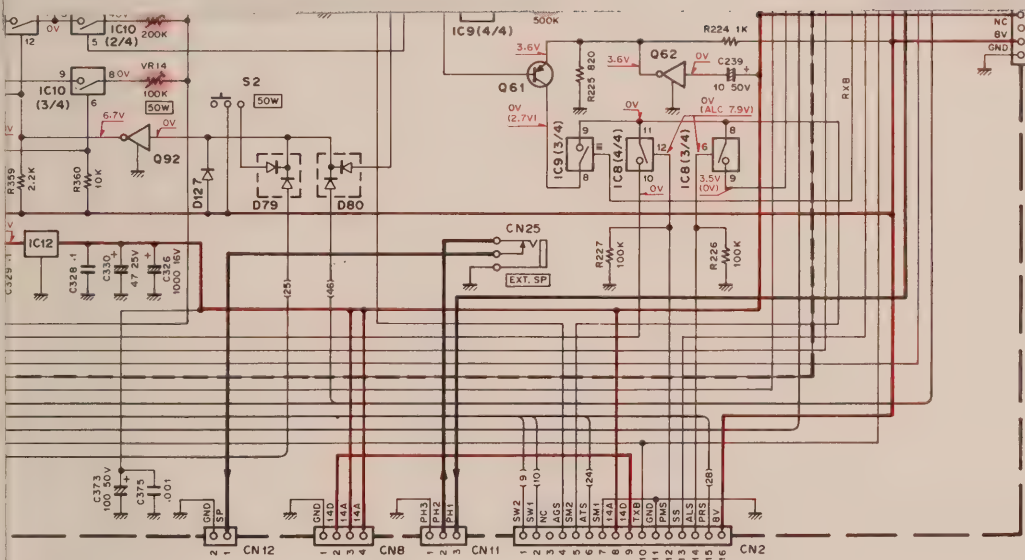
CONTROL UNIT (X53-3100-XX) -11: TS-140S -12: TS-680S Foil side view



PC BOARD VIEWS TS-140S/680S

- | | | |
|-----------------------|--------------------------------------------------------------------------------|----------------------|
| 2SC1959(Y)
2SC1971 | MB87006
MB4052 | 2SC2787(L) |
| 2SC2509 | PST520D | DTC124ES |
| 2SD1406(Y) | TC4069UBP | M74LS93P
SN76514N |
| AN7805 | SN74LS138N | BU18400A |
| M54927P | TC5518CPL-20 | MBM27C128-25JAJ2 |
| M54459L
M54460L | TMP8255AP-5 | |
| SN74LS90N | LZ92K37 | |
| SN16913P
NE555C | 2SC2458(Y) DTA143ES
2SC2459(BL) DTC144WS
2SC2668(Y) DTC143TS
DTA124ES | |





- (X59-3000-02)
Q1 : 2SC2712 (Y)
- IC1 : NJM4558M
- (X59-3340-00)
Q1,2 : 2SA1204 (Y)
Q3 : 2SA1182 (Y)
Q4,5 : DTC114EK
- D1,2 : DAN202 (K)
- (X59-3350-00)
Q1,2 : DTC114EK
- IC1 : TC4011BF
- (X59-3360-00)
Q1~5 : DTC114EK
Q6 : DTA114EK
Q7 : DTC114TK
- D1 : DAN202 (K)
- IC1 : MB74LS122

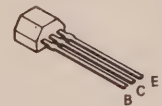
3SK122(L)



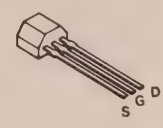
3SK73(GR)



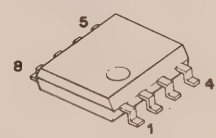
2SC2668(Y)



2SK192A(Y)
2SK192A(GR)*J



NJM4558M



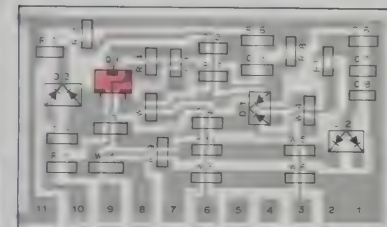
2SA1204(Y)



TS-140S/680S PC BOARD VIEWS (TS-680S)

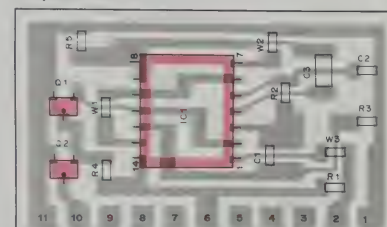
SIDE TONE (X59-1060-00)

Component side view



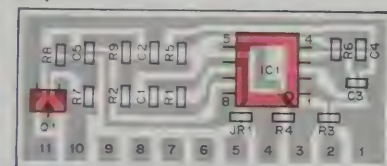
NB2 (X59-3350-00)

Component side view



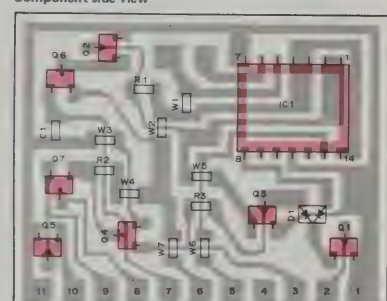
FM MIC AMP. (X59-3000-02)

Component side view



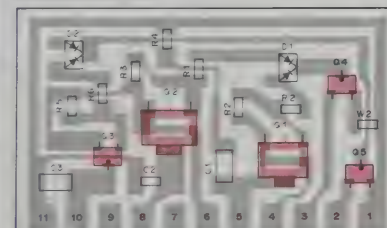
DELAY TIME (X59-3360-00)

Component side view

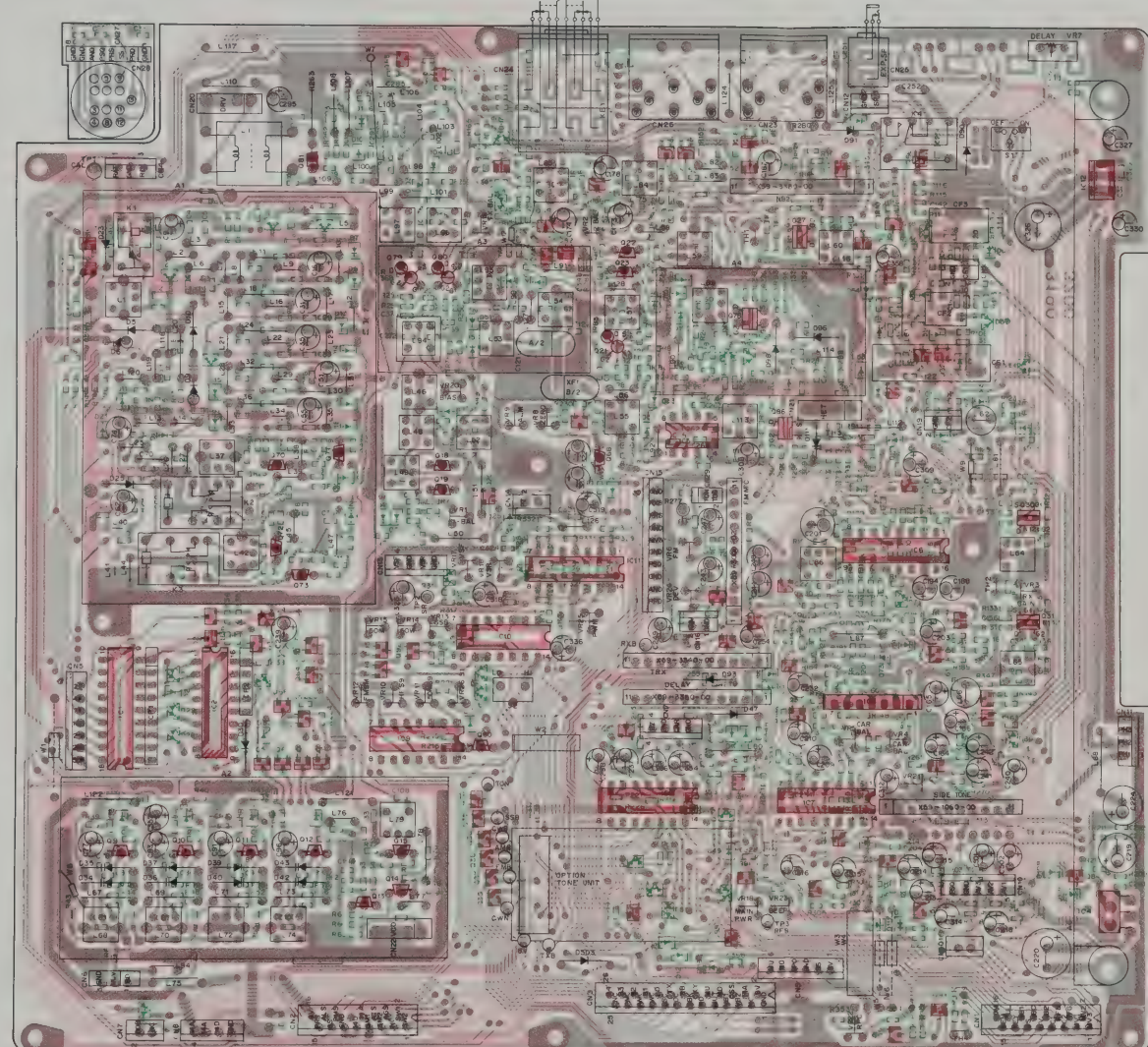


TRX (X59-3340-00)

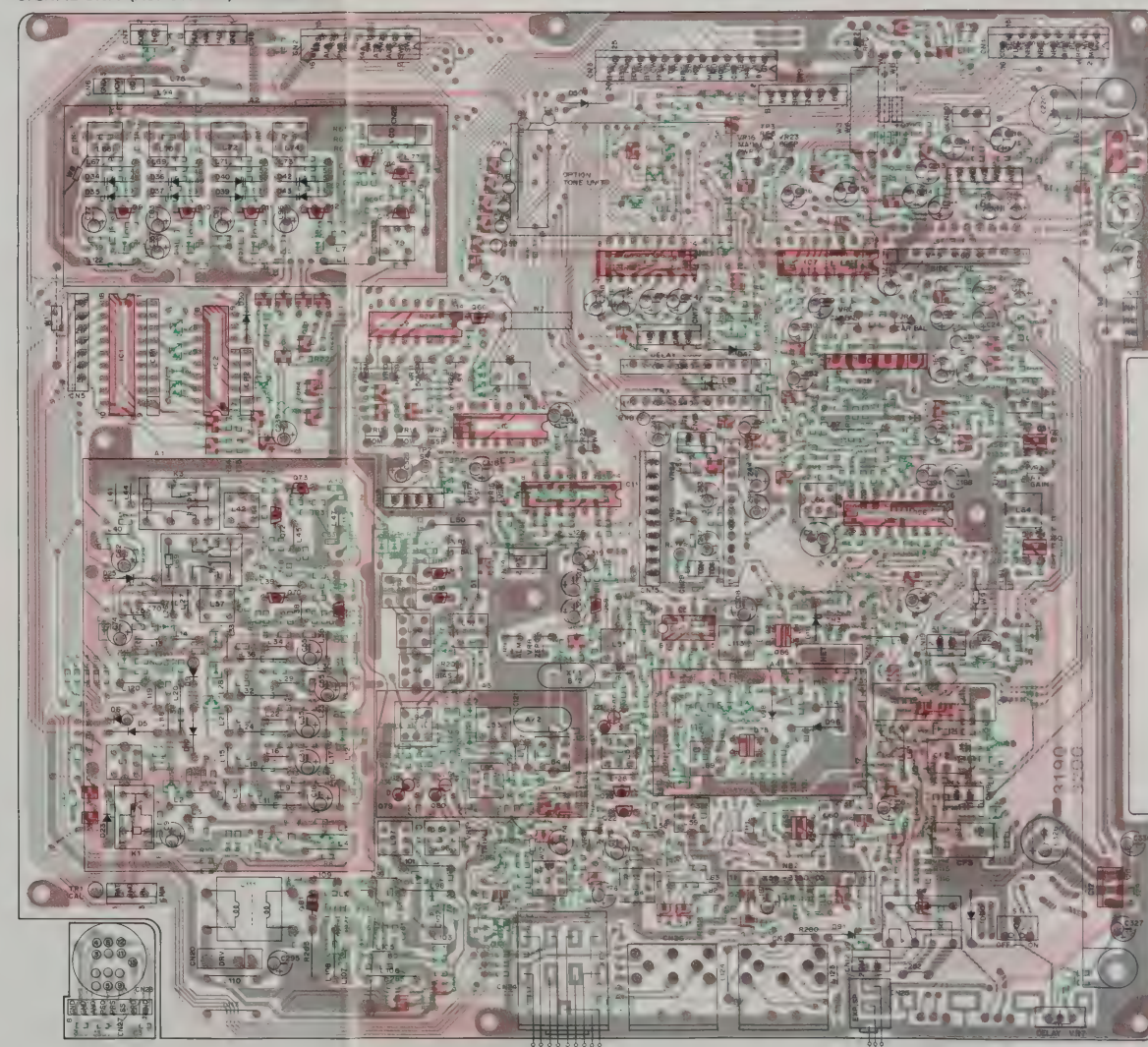
Component side view

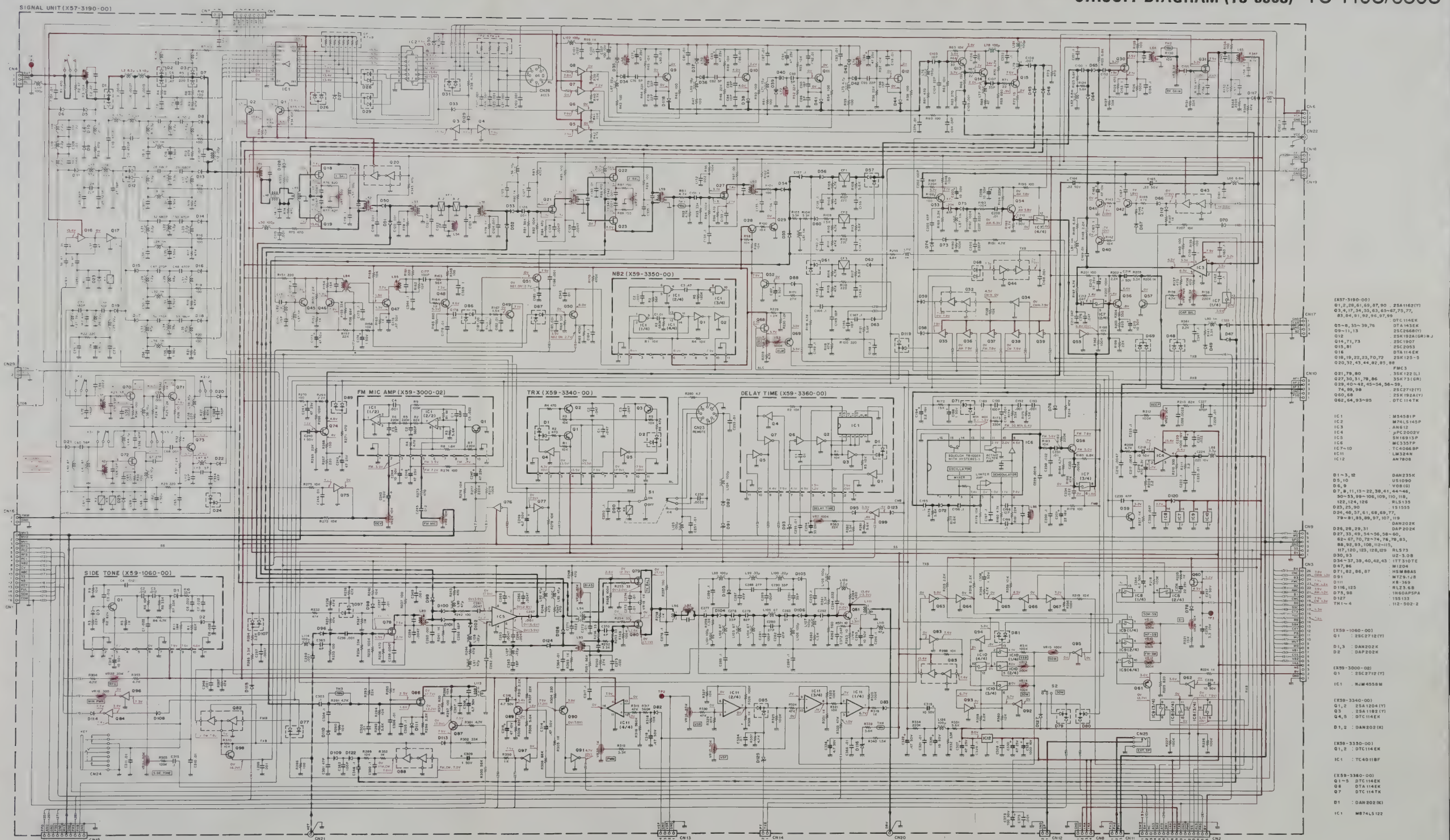


SIGNAL UNIT (X57-3190-00) Component side view



SIGNAL UNIT (X57-3190-00) Foil side view





(X57-3190-00)
 Q1,2,20,61,69,87,90 : 2SA1162(Y)
 Q3,4,17,34,35,63,65-67,73,77,
 83,84,91,92,96,97,99
 Q5-8,35-39,76 : DTC114EK
 Q9-11,13 : 2SC2668(Y)
 Q12 : 2SK192A(GR)+J
 Q15,67 : 2SC1907
 Q16,81 : 2SC2053
 Q18 : DTA114EK
 Q19,18,22,23,70,72 : 2SK125-5
 Q20,32,43,44,82,85,88 : FMC3
 Q21,79,80 : 3SK122(L)
 Q27,30,31,79,86 : 3SK73(GR)
 Q32,40-42,45-54,56-58 : 2SK192A(V)
 Q4,69,98 : 2SC2712(Y)
 Q62,64,93-95 : DTC114TK

IC1 : M54581P
 IC2 : M74LS145P
 IC3 : AN612
 IC4 : μ PC2002V
 IC5 : SN16913P
 IC6 : MC3357P
 IC7-10 : TC4066BP
 IC11 : LM324N
 IC12 : AN7808

D1-3,12 : DAN235K
 D5,10 : US1090
 D6,9 : V88(G)
 D7,8,11,13-22,39,41,44-46,50-53,59-106,109,110,118,
 122,124,126 : R15315
 D23,25,90 : 151555
 D24,48,57,61,68,69,77,
 79-81,83,85,97,107,119 : DAN202K
 D26,28,29,31 : DAN202K
 D27,32,49,54-56,58-60,
 64-67,70,72-74,76,78,83,
 86,95,95,108,111-115,
 117,120,123,125,129 : RL573
 D30,43 : U2-5,0B
 D34-37,39,40,46,43 : ITT310TE
 D47,96 : M2024
 D71,82,86,87 : HSM88AS
 D91 : M72L18
 D111 : μ R-169
 D116,125 : RL23.5B
 D74,94 : 1860AP5P
 D127 : 155133
 TH1-4 : 112-502-2

(X59-1060-00)
 D1 : 2SC2712(Y)
 D1,3 : DAN202K
 D2 : DAP202K

(X59-3000-02)
 Q1 : 2SC2712(Y)
 IC1 : NJM4558M

(X59-3340-00)
 Q1,2 : 2SA1204(Y)
 Q3 : 2SA1162(Y)
 Q4,5 : DTC114EK
 D1,2 : DAN202(K)

(X59-3350-00)
 Q1,2 : DTC114EK
 IC1 : TC4011BF

(X59-3360-00)
 Q1-5 : DTC114EK
 Q8 : DTA114EK
 Q7 : DTC114TK
 D1 : DAN202(K)
 IC1 : M74LS122

M74LS145P

 μ PC2002V

SN16913P

MC3357P

AN7808

AN612

TC4066BP

LM324N

2SA1162(Y)

2SA1182(Y)

2SC2053

2SC1907

2SK125-5

FMC3

3SK122(L)

3SK73(GR)

2SC2668(Y)

2SK192A(Y)

2SK192A(GR)+J

NJM4558M

2SA1204(Y)

TC4011BF

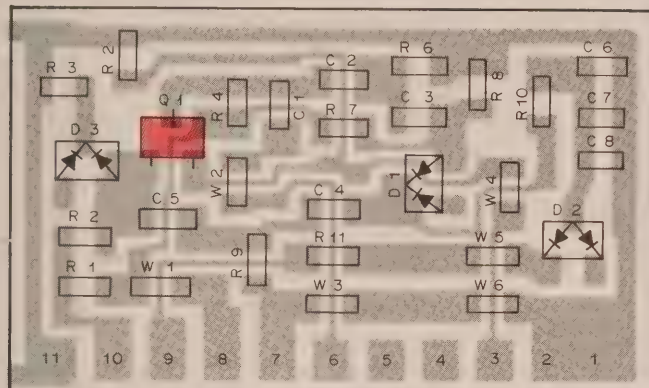
M74LS122

M54581P

TS-140S/680S PC BOARD VIEWS (TS-140S)

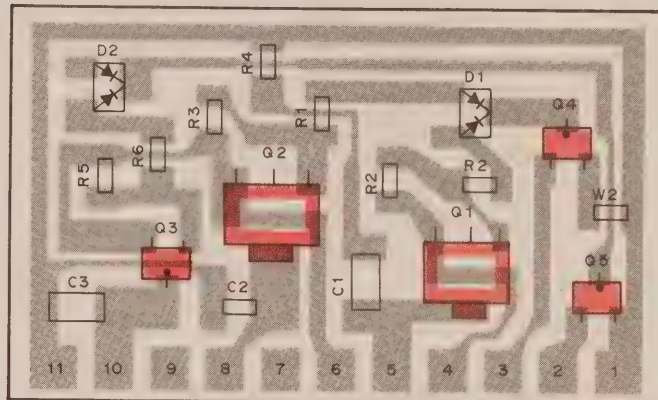
SIDE TONE (X59-1060-00)

Component side view



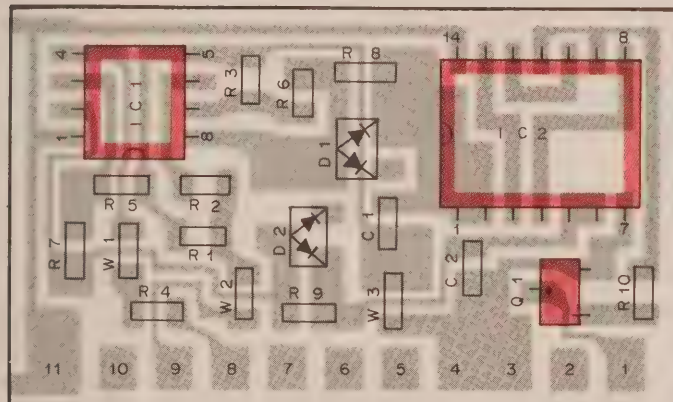
TRX (X59-3340-00)

Component side view



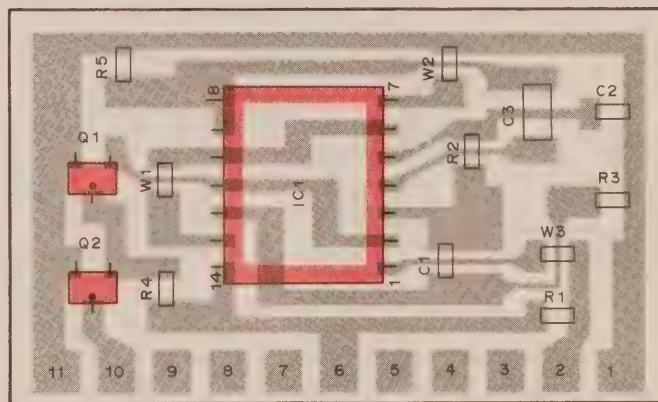
VOX (X59-1080-00)

Component side view



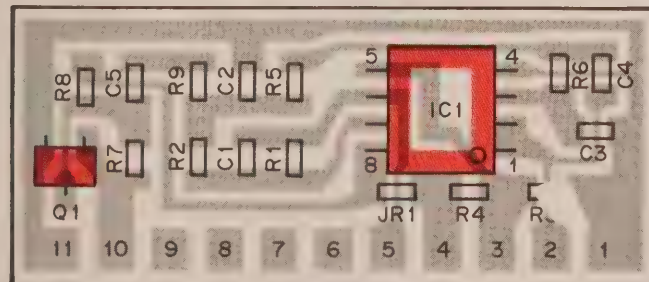
NB2 (X59-3350-00)

Component side view



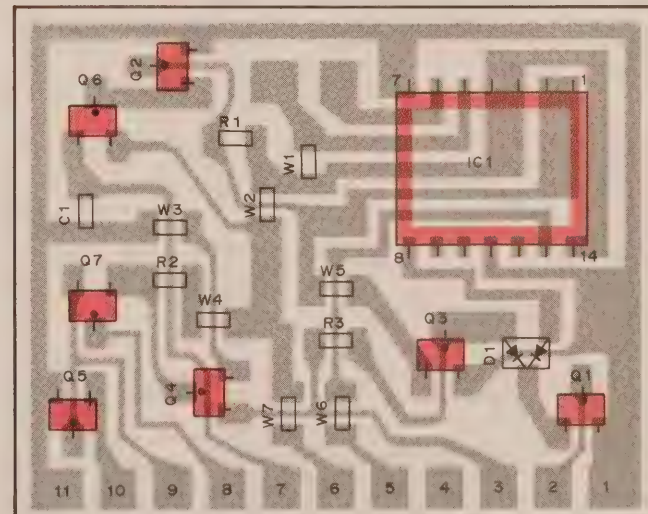
FM MIC AMP. (X59-3000-02)

Component side view



DELAY TIME (X59-3360-00)

Component side view



TERMINAL FUNCTION

TERMINAL FUNCTION

TERMINAL FUNCTION

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal Function
SWITCH UNIT (X41-3030-XX)			
CN1	1	GND	GND
	2	PPD	Packet power down
	3	RXB	RX power supply (+8V)
	4	PRS	Processor switch
	5	NC	Not connected
	6	MV3	Mic amp. output
CN2	1	SS	Standby switch
	2	SV	+8V
CN3	1	SS	Standby switch
	2	PKS	Packet standby
	3	GND	GND
	4	PKD	Packet data input
CN4 (TS-140S)	1	GND	GND
	2	VOX	VOX
CN5	1	MIC	Mic amp. input
	2	GND	GND
	3	BM	+8V (Mic)
	4	SS	Standby switch
CN6	1	AF1	AF GAIN GND
	2	AF2	AF GAIN volume
	3	AF3	AF GAIN input
	4	GND	GND
	5	FSQ	Squelch volume
	6	NC	Not connected
CN7	1	GND	GND
	2	RIT	RIT data
	3	PIB	RIT volume
	4	IFS	IF shift data
	5	IFB	IF shift volume
CN8	1	PH2	Phone output
	2	PH1	Phone input
	3	PH3	Phone GND
100W FINAL UNIT (X45-3100-XX)			
CN1	1	TXB	TX power supply (+8V)
	2	50B (NC)	50MHz power supply (TS-680S)
	3	PT	Temperature protection signal
CN2	1	GND	GND
	2	14D	+14V (DC-DC converter)
	3	14A	+14V
	4	14A	+14V
CN3	1	5A	+5V (PLL)
	2	5B	+5V (Microprocessor)
	3	GND	GND
CN4 (TS-680S)	1	50T	50MHz TX power supply (+8V)
	2	14S	+14V
	3	14S	+14V
CN5	1	MOT +	Fun motor power supply +
	2	MOT -	Fun motor power supply -
	1	DRV	Drive input
	2	GND	GND
	1	PO	Power output
	2	GND	GND
(TS-680S)	1	50D	50MHz drive output
	2	GND	GND
	1	14S	+14V
	2	14	+14V
	1	GND	GND
	2	GND	GND

Connector No.	Terminal No.	Terminal Name	Terminal Function
FILTER UNIT (X51-3040-XX)			
CN1	1	RL	Relay power supply (TX 13V)
	2	RAT	RX antenna output
	3	GND	GND
CN2 (TS-680S)	1	50T	50MHz TX power supply
	2	14S	+14V
	3	14S	+14V
CN3	1	50F (NC)	50 ~ 54MHz (TS-680S)
	2	14F	7.5 ~ 14.5MHz
	3	28F	21.5 ~ 30MHz
	4	7F	4 ~ 7.5MHz
	5	21F	14.5 ~ 21.5MHz
	6	4F	2.5 ~ 4MHz
	7	2F	~ 2.5MHz
CN4	1	VSF	Forward wave voltage
	2	GND	GND
	3	VSR	Reflected wave voltage
	4	GND	GND
CN5	1	PO	Power input
	2	GND	GND
CN6 (TS-680S)	1	50D	50MHz drive input
	2	GND	GND
	1	ANT	Antenna
	2	GND	GND
CONTROL UNIT (X53-3100-XX)			
CN1	1	CAR	Carrier output (455kHz)
	2	GND	GND
CN2	1	5A	+5V (PLL)
	2	5B	+5V (Microprocessor)
	3	GND	GND
CN3	1	VCO	VCO input
	2	GND	GND
CN4	1	GND	GND
	2	VCV	VCO control voltage
	3	8D	+8V (Active low-pass filter)
CN5	1	FMM	FM modulation signal input
	2	GND	GND
CN6	1	HET	Heterodyne output
	2	GND	GND
CN7	1	BZ	Beep sound output
	2	NC	Not connected
CN8	1	5B	+5V (Interface)
	2	RDY	Ready
	3	CD	Control data
	4	CS	Chip select
	5	RD	Read enable
	6	WR	Write enable
	7	GND	GND
CN9	1	RES	Reset
	2	D0	Antenna select signal
	3	D1	
	4	D2	
	5	D3	Microprocessor data bus 0 ~ 7
	6	D4	
	7	D5	
	8	D6	
	9	D7	

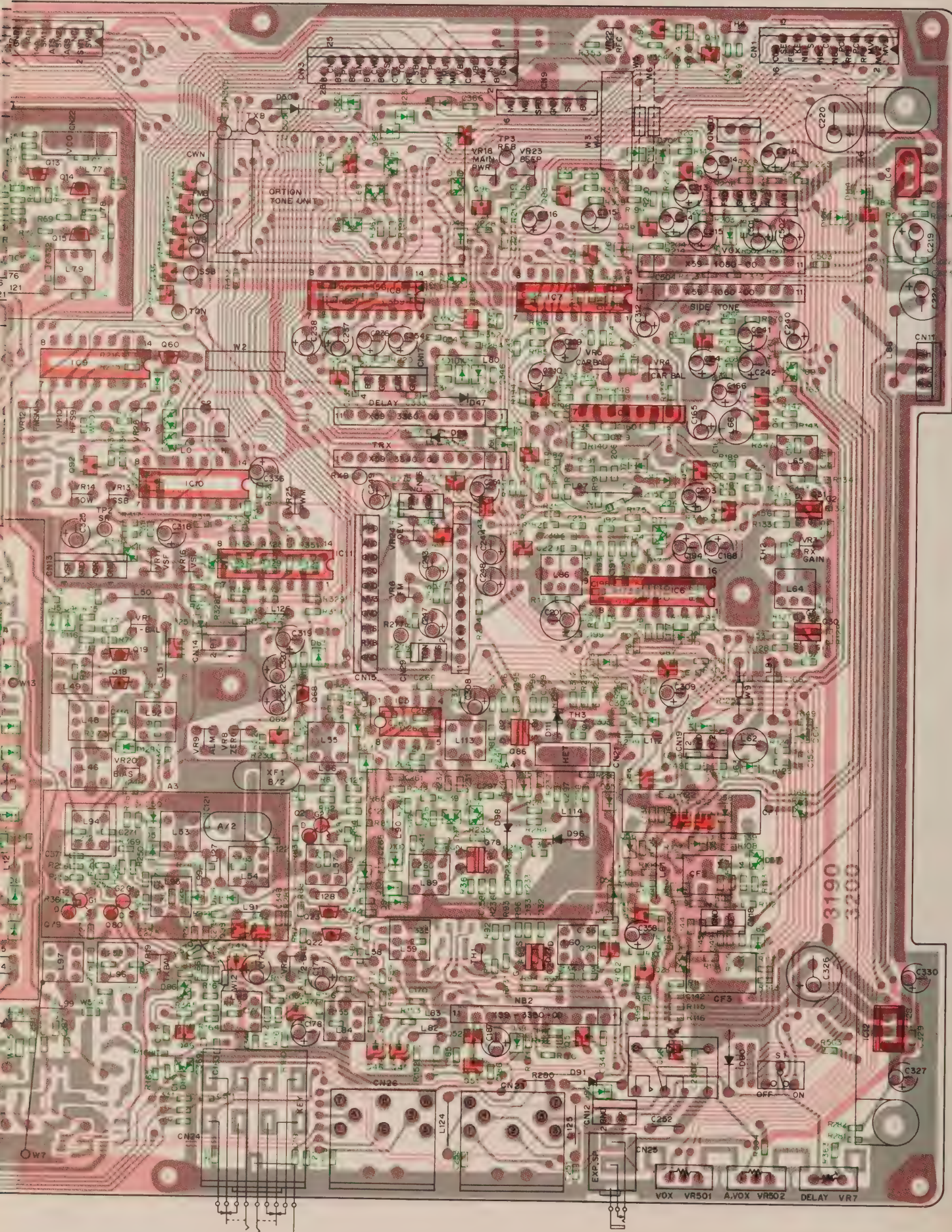
Connector No.	Terminal No.	Terminal Name	Terminal Function
CN10	1	B4	Band data
	2	CNC	CW narrow mode data
	3	B3	Band data
	4	FMC	FM mode data
	5	B2	Band data
	6	AMC	AM mode data
	7	B1	Band data
	8	CWC	CW mode data
	9	B0	Band data
	10	SSC	SSB mode data
	11	CTX	Transmit timing control signal
	12	TOC	Sub-tone control signal
	13	RB	Receive timing control signal
	14	SBK	Blanking signal
	15	CKY	Keying control signal
	16	PD	Power down signal
CN11	1	MU	Mic up data
	2	MUT	Mute signal
	3	MD	Mic down data
	4	VB1	VCO switching signal
	5	SS	Standby control data
	6	VB2	VCO switching signal
	7	14A	+14V
	8	NC	Not connected
	9	8V	+8V
	10	GND	GND
	1	CK4	Sub-encoder pulse input
	2	CK3	Sub-encoder pulse input
	3	5C	+5V (Display)
	4	L1	LED (1MHz)
	5	K0	Key scan input
	6	LF	LED (F. LOCK)
CN12	1	K1	Key scan input
	2	LM	LED (M.SCR)
	3	K2	Key scan input
	4	XP	Display function signal
	5	K3	Key scan input
	6	SLH	Display serial data (Latch signal)
	7	S0	Key scan output
	8	SDA	Display serial data
	9	S1	Key scan output
	10	SDA	Display serial data
	11	S2	Key scan output
	12	SLH	Display serial data (Latch signal)
	13	K3	Key scan output
	14	XP	Display function signal
	15	K2	Key scan output
	16	LM	LED (M.SCR)
CN13	1	LF	LED (F. LOCK)
	2	K0	Key scan output
	3	L1	LED (1MHz)
	4	5C	+5V (Display)
	5	CK3	Sub-encoder pulse output
CN14	1	CK4	Sub-encoder pulse output
	2	SPO	Speaker output
	3	8M	+8V
	4	GND	GND
	5	MU	Mic up data
CN5	1	MD	Mic down data
	2	SS	Standby switch
	3	MIC	Microphone
	4	GND	GND
	5	GND	GND

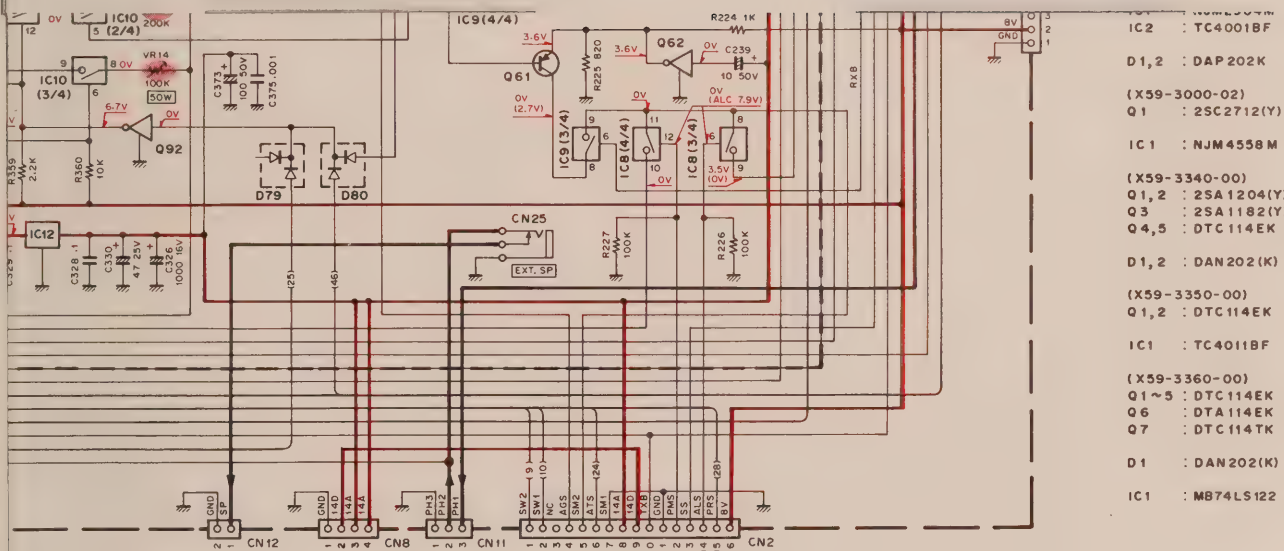
Connector No.	Terminal No.	Terminal Name	Terminal Function
DISPLAY UNIT (X54-3050-XX)			
CN1	1	SM1	S meter -
	2	SM2	S meter +
CN2	1	8V	+8V
	2	PRS	Processor switch
	3	ALS	ALC meter switch
	4	SS	Standby switch
	5	PMS	Power meter switch
	6	GND	GND
	7	TXB	TX power supply (+8V)
	8	14D	+14V (DC-DC converter)
	9	14A	+14V
	10	SM1	S meter -
	11	ATS	RF ATT switch
	12	SM2	S meter +
	13	AGS	AGC switch
	14	NC	Not connected
	15	SW1	RF amplifier signal (TS-680S)
	16	SW2	VOX signal (TS-140S)
CN3	1	COM	Break in input
	2	SEM	Semi-break in signal
	3	FUL	Full break in signal
	4	KEY	Key signal
	5	NB1	Noise blanker 1 switch
	6	SS	Standby signal
	7	NBC	NB time constant
	8	CV	Carrier volume
	9	NB2	Noise blanker 2 switch
	10	PC1	Power control volume
	11	RFB	RF GAIN input
	12	PC2	Power control volume
	13	RFG	RF GAIN volume output
	14	MV1	Mic volume GND
	15	MV2	Mic volume output
	16	MV3	Mic volume input
CN4	1	S3	Key scan input
	2	S2	Key scan input
	3	SCK	Display serial clock
	4	S1	Key scan input
	5	SDA	Display serial data
	6	S0	Key scan output
	7	SLH	Display serial data (Latch signal)
	8	K3	Key scan output
	9	XP	Display function signal
	10	K2	Key scan output
	11	LM	LED (M.SCR)
	12	K1	Key scan output
	13	LF	LED (F. LOCK)
	14	K0	Key scan output
	15	L1	LED (1MHz)
	16	5C	+5V (Display)
CN5	1	CK3	Sub-encoder pulse output
	2	CK4	Sub-encoder pulse output
	3	SPO	Speaker output
	4	8M	+8V
	5	GND	GND
	6	MU	Mic up data
	7	MD	Mic down data
	8	GND	GND

Connector No.	Terminal No.	Terminal Name	Terminal Function
SIGNAL UNIT (X57-3190-00) : TS-680S			
SIGNAL UNIT (X57-3200-XX) : TS-140S			
CN1	1	MV3	Mic volume output
	2	MV2	Mic volume input
	3	MV1	Mic volume GND
	4	RFG	RF GAIN volume input
	5	PC2	Power control volume
	6	RFB	RF GAIN output
	7	PC1	Power control volume
	8	NB2	Noise blanker 2 switch
	9	CV	Carrier volume
	10	NBC	NB time constant
	11	SS	Standby switch
	12	NB1	Noise blanker 1 switch
	13	KEY	Key signal
	14	FUL	Full break in signal
	15	SEM	Semi-break in signal
	16	COM	Break in output
CN2	1	SW2	RF amplifier signal (TS-680S)
	2	SW1	VOX signal (TS-140S)
	3	NC	Not connected
	4	AGS	AGC switch
	5	SM2	S meter +
	6	ATS	RF ATT switch
	7	SM1	S meter -
	8	14A	+14V
	9	14D	+14V (DC-DC converter)
	10	TXB	TX power supply (+8V)
	11	GND	GND
	12	PMS	Power meter switch
	13	SS	Standby switch
	14	ALS	ALC meter switch
	15	PRS	Processor switch
	16	8V	+8V
CN3	1	GND	GND
	2	8V	+8V
	3	NC	Not connected
	4	14A	+14V
	5	VB2	VCO switching signal
	6	SS	Standby control data
	7	VB1	VCO switching signal
	8	MD	Mic down data
	9	MUT	Mute signal
	10	MU	Mic up data
	11	PD	Power down signal
	12	CKY	Keying control signal
	13	SBK	Blanking signal
	14	RB	Receive timing control signal
	15	TOC	Sub-tone control signal
	16	CTX	Transmit timing control signal
CN4	1	SSC	SSB mode data
	2	B0	Band data
	3	CWC	CW mode data
	4	B1	Band data
	5	AMC	AM mode data
	6	B2	Band data
	7	FMC	FM mode data
	8	B3	Band data
CN5	1	RAT	RX antenna input
	2	GND	GND
	3	RL	Relay power supply (TX 13V)

Connector No.	Terminal No.	Terminal Name	Terminal Function
CN5	1	50F (NC)	50 ~ 54MHz (TS-680S)
	2	28F	21.5 ~ 30MHz
	3	21F	14.5 ~ 21.5MHz
	4	14F	7.5 ~ 14.5MHz
	5	7F	4 ~ 7.5MHz
	6	4F	2.5 ~ 4MHz
	7	2F	~ 2.5MHz
CN6	1	8D	+8V (Active low-pass filter)
	2	VCV	VCO control voltage

-61 : W Foil side view



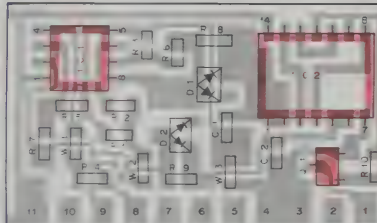


TS-140S/680S PC BOARD VIEWS (TS-140S)

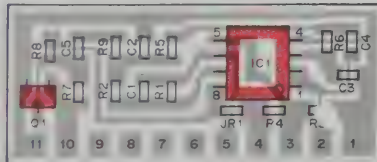
SIDE TONE (X59-1060-00)
Component side view



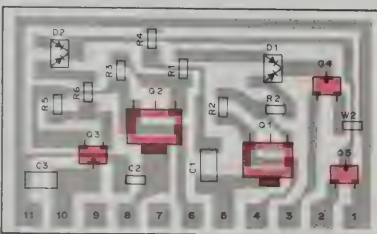
VOX (X59-1080-00)
Component side view



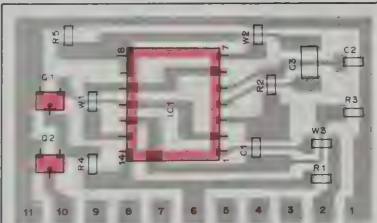
FM MIC AMP. (X59-3000-02)
Component side view



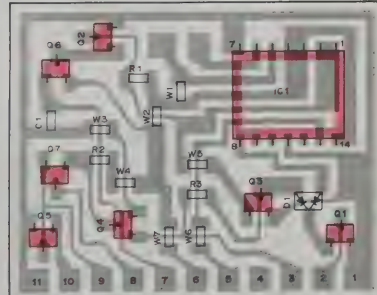
TRX (X59-3340-00)
Component side view



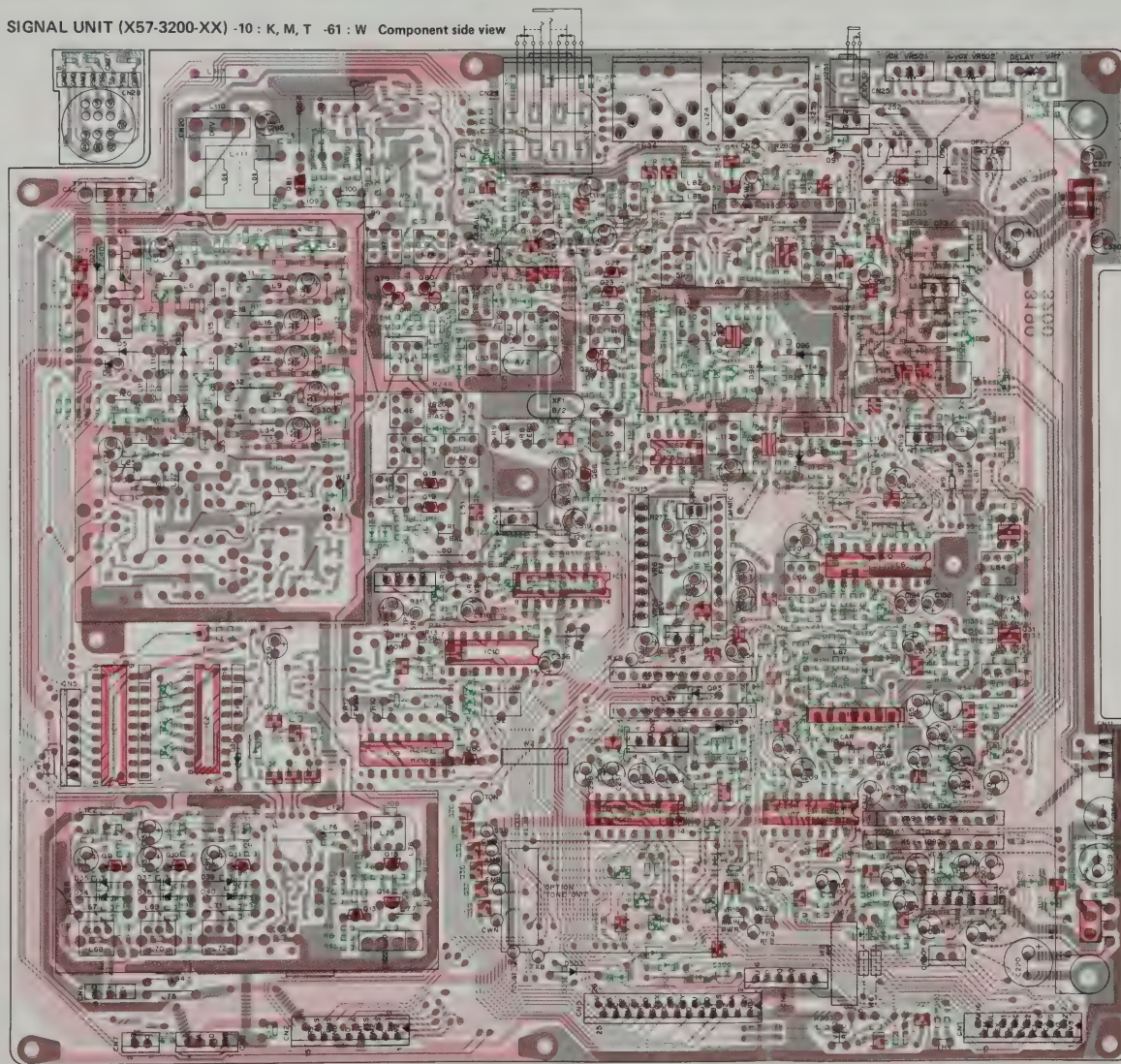
NB2 (X59-3350-00)
Component side view



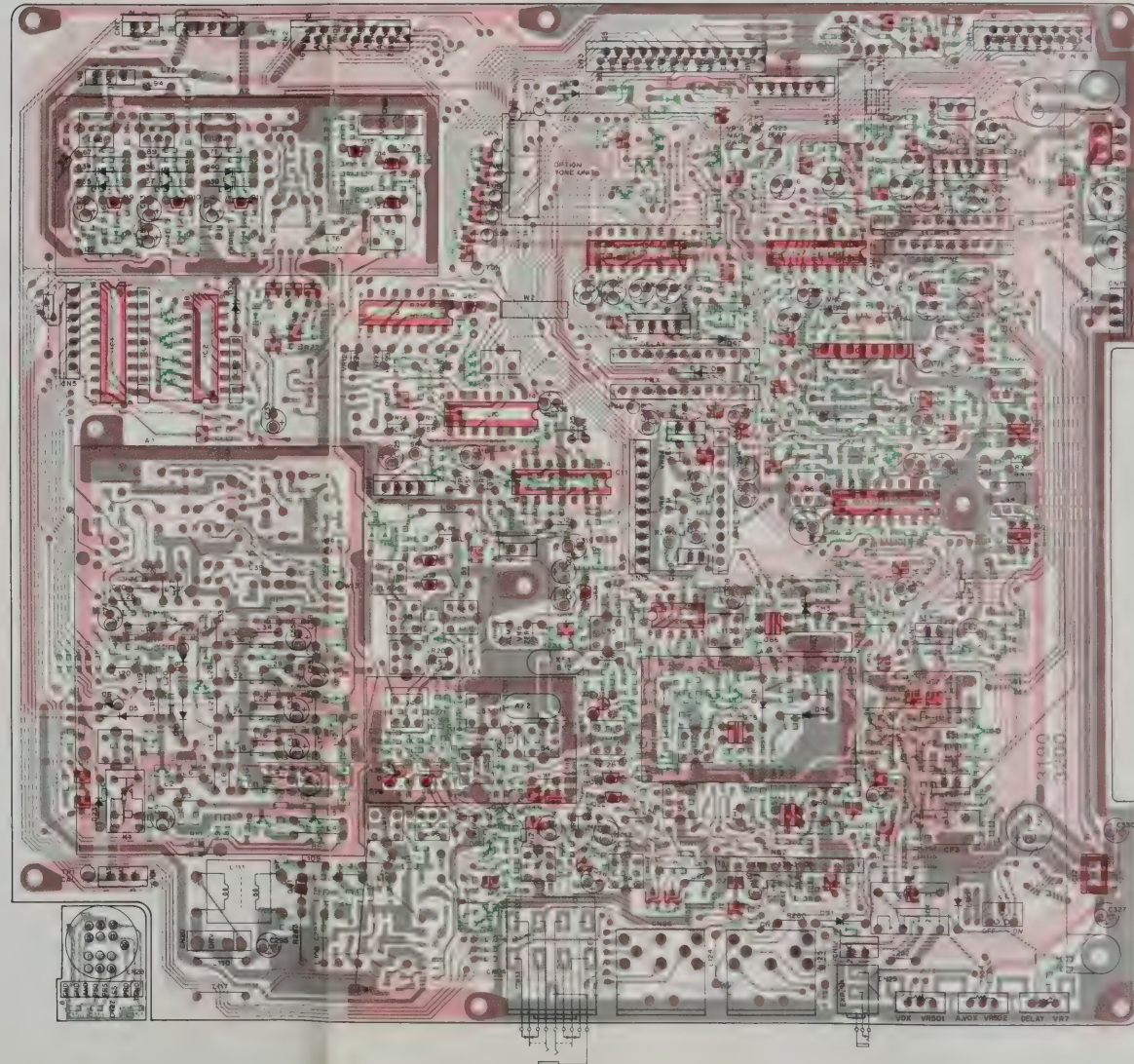
DELAY TIME (X59-3360-00)
Component side view

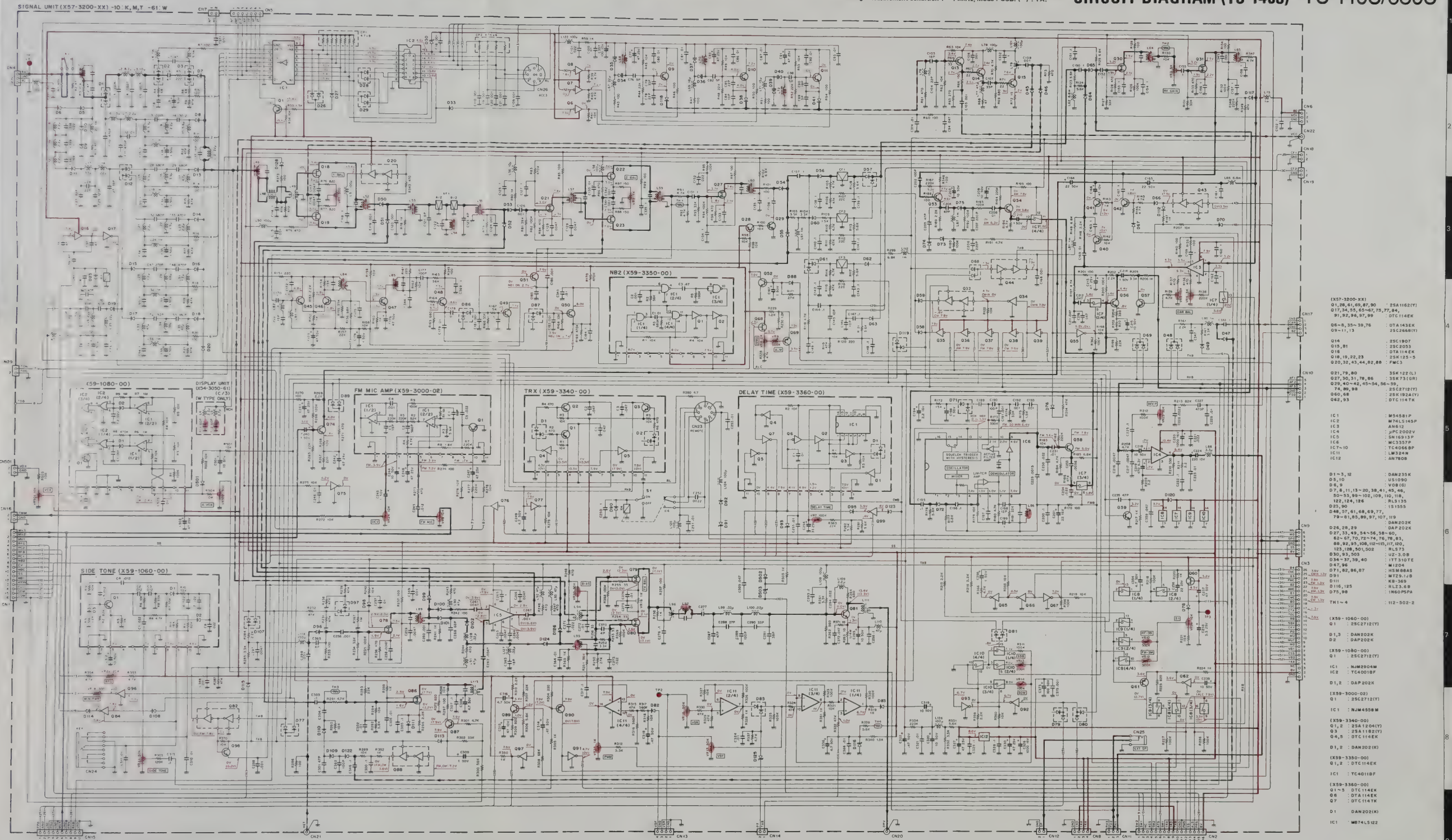


SIGNAL UNIT (X57-3200-XX) -10 : K, M, T -61 : W Component side view



SIGNAL UNIT (X57-3200-XX) -10 : K, M, T -61 : W Foil side view





M74LS145P

JPC2002V

SN16913P

MC3357P

AN7808

AN612

TC4068BP

LM324N

2SA1162(Y)

2SA1182(Y)

2SC2712(Y)

DTA114EK

DTC114EK

DTC114TK

2SC2053

2SC1907

2SK125-5

FMC3

3SK122(L)

3SK73(OR)

TC4001BF

TC4011BF

M74LS122

M54581P

2SC2712(Y)

2SA1182(Y)

DTA114EK

DTC114EK

DTC114TK

2SC2053

2SC1907

2SK125-5

FMC3

3SK122(L)

3SK73(OR)

2SC2668(Y)

2SK192A(Y)

2SK192A(OR)+J

NJM2904M

NJM4558M

2SA1204(Y)

2SC2712(Y)

DTA114EK

DTC114EK

DTC114TK

2SC2053

2SC1907

2SK125-5

FMC3

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2SC2668(Y)

2SK192A(Y)

2SK192A(OR)+J

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DTC114TK

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2SK192A(Y)

2SK192A(OR)+J

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FMC3

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2SK192A(OR)+J

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2SK192A(OR)+J

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2SC2712(Y)

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NJM4558M

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2SC2712(Y)

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DTC114EK

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DTC114EK

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2SK192A(OR)+J

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NJM4558M

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DTC114EK

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NJM4558M

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2SC2712(Y)

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3SK122(L)

3SK73(OR)

2SC2668(Y)

2SK192A(Y)

2SK192A(OR)+J

NJM2904M

NJM4558M

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2SC2712(Y)

DTA114EK

DTC114EK

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2SC1907

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2SK192A(Y)

2SK192A(OR)+J

NJM2904M

NJM4558M

2SA1204(Y)

2SC2712(Y)

DTA114EK

DTC114EK

DTC114TK

2SC2053

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FMC3

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3SK73(OR)

2SC2668(Y)

2SK192A(Y)

2SK192A(OR)+J

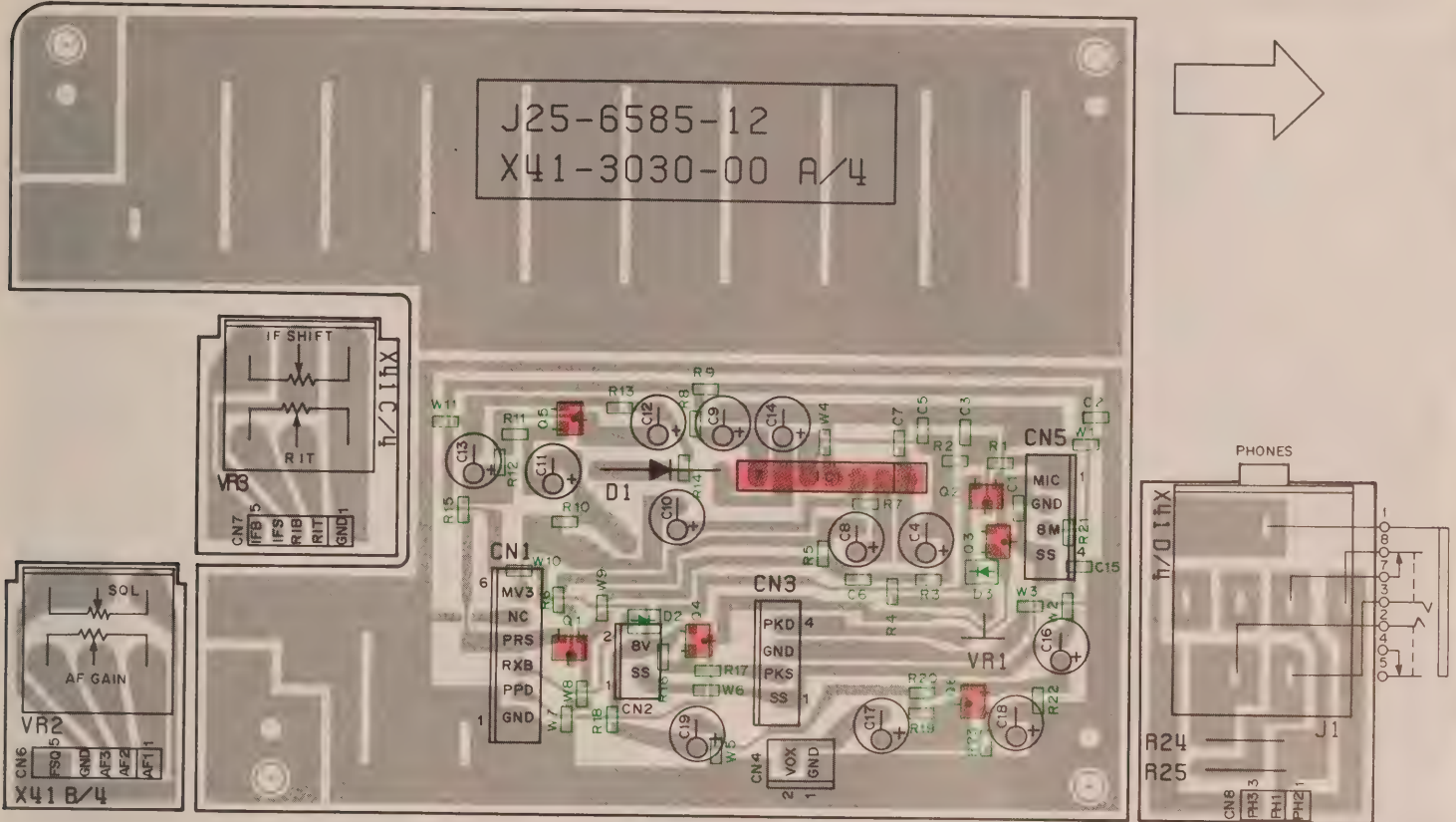
NJM2904M

NJM4558M

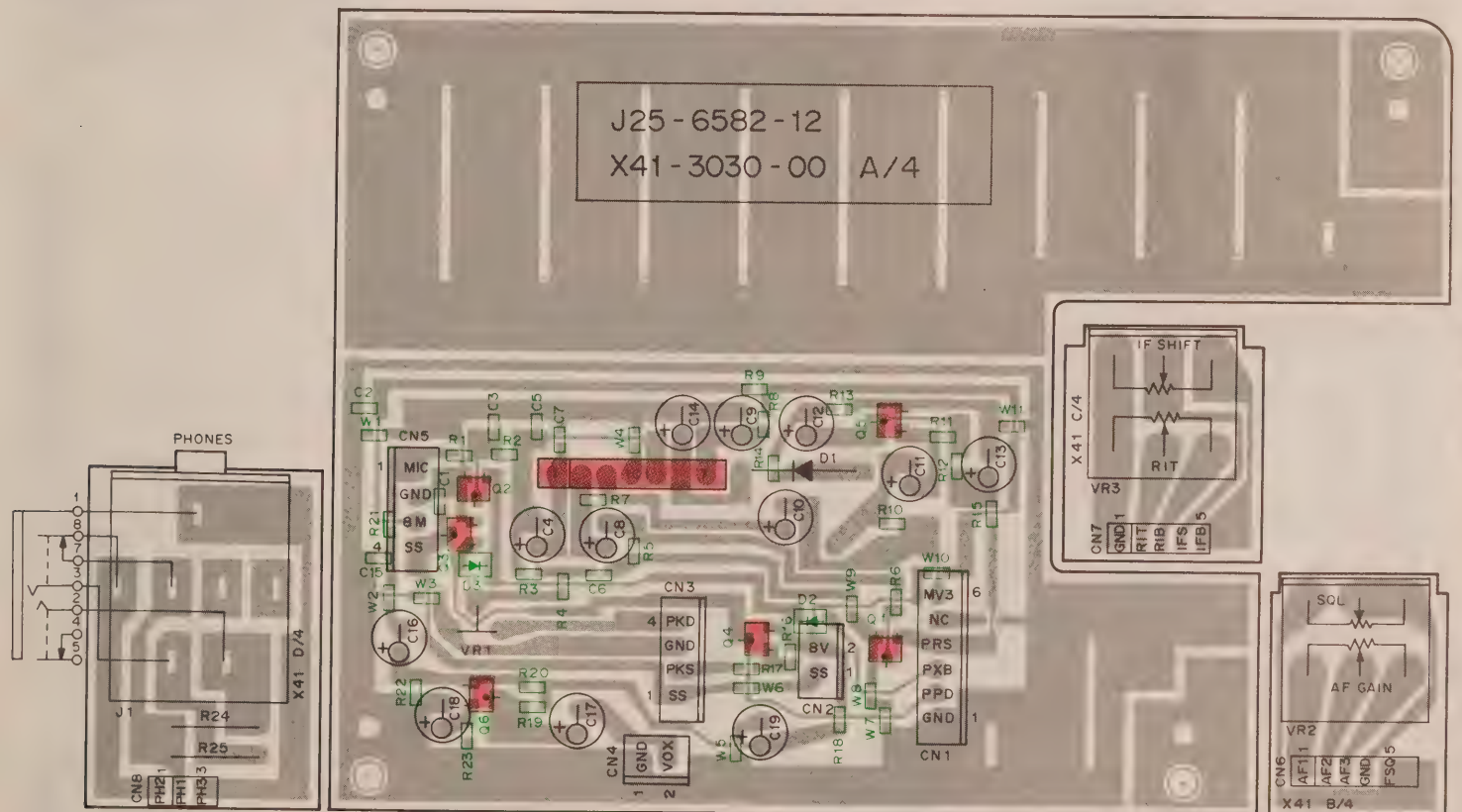


PC BOARD VIEWS TS-140S/680S

SWITCH UNIT (X41-3030-XX) -00 : TS-680S -11 : TS-140S Component side view



SWITCH UNIT (X41-3030-XX) -00 : TS-680S -11 : TS-140S Foil side view

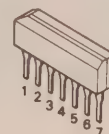


Q1-3 : DTC114EK Q4 : 2SA1162(Y) Q5,6 : 2SC2712(Y)
IC1 : μ PC1158H2
D1 : 1N60 D2,3 : RLS73

CN4, Q6
C16-C19
R18-R23 } TS-140S only

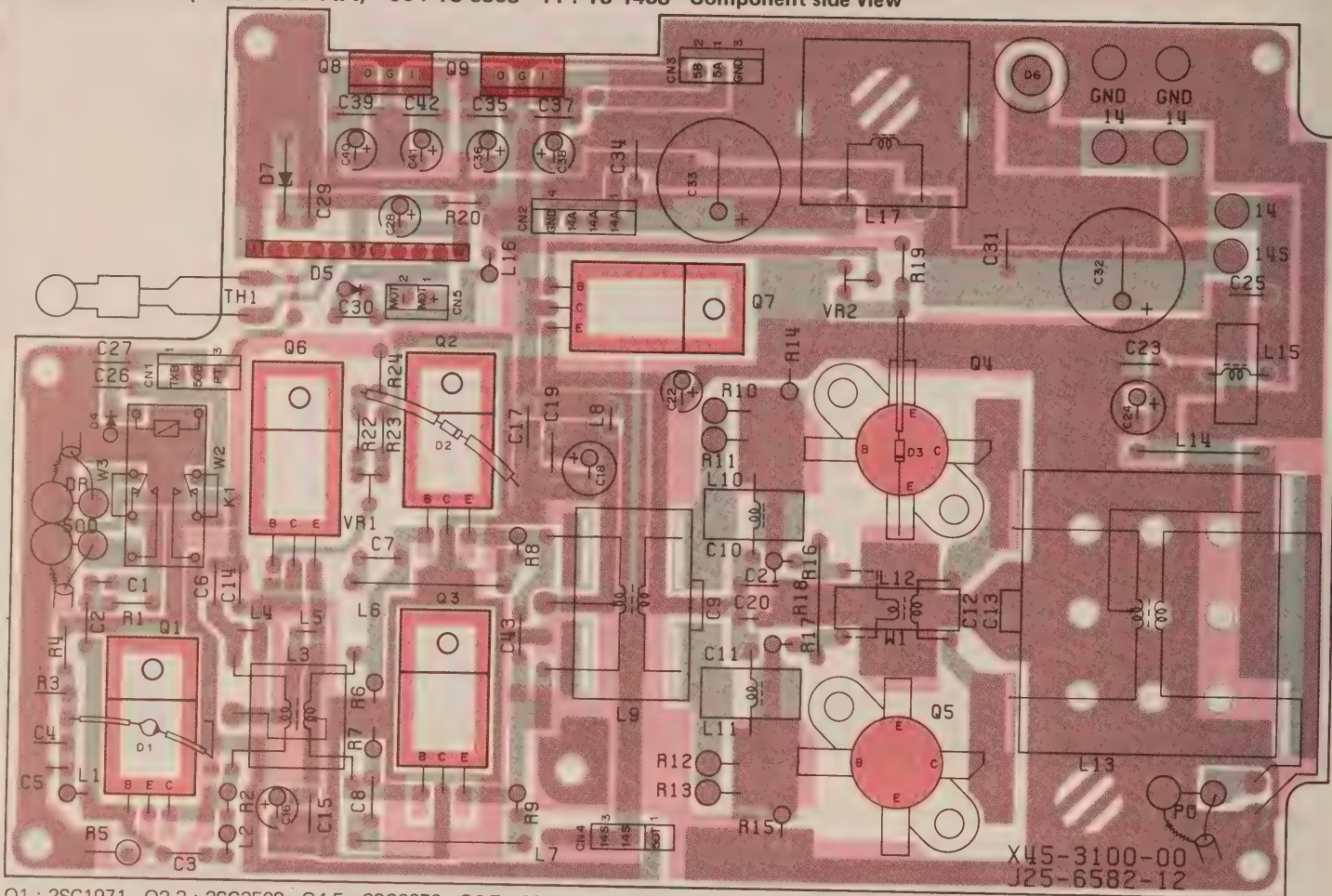
μ PC1158H2

2SA1162(Y)
2SC2712(Y)
DTC114EK



TS-140S/680S PC BOARD VIEWS

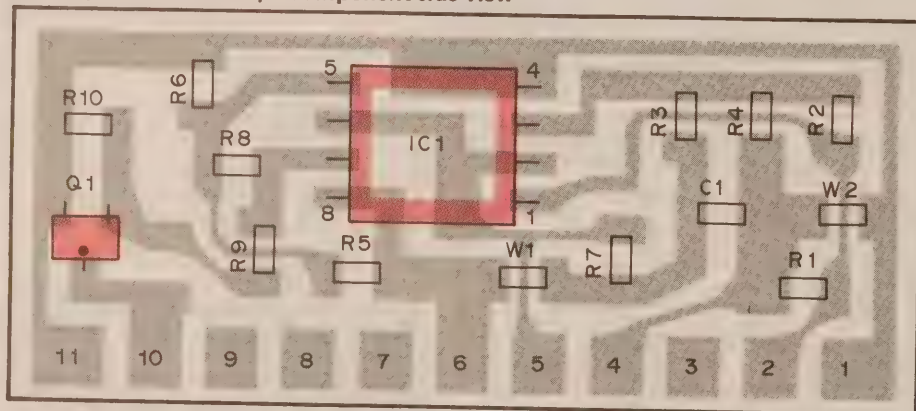
FINAL UNIT (X45-3100-XX) -00 : TS-680S -11 : TS-140S Component side view



Q1 : 2SC1971 Q2,3 : 2SC2509 Q4,5 : 2SC2879 Q6,7 : 2SD1406(Y) Q8,9 : AN7805
 D1 : MV-5T D2,3 : SV-03YS D4,5 : 1S1555 D6 : SG-5LR D7 : MTZ8.2JA
 TH1 : 5TP41L

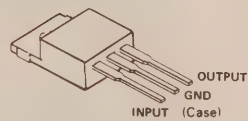
K1, D4, CN4, 50D : TS-680S only
 W2, 3 : TS-140S only

FAN (X59-3370-00) Component side view



Q1 : 2SC2712(Y)
 IC1 : NJM4558M

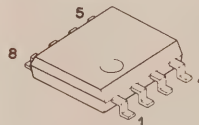
AN7805



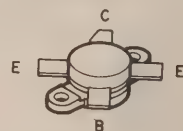
2SC2712(Y)



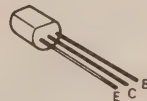
NJM4558M



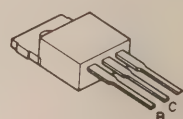
2SC2879



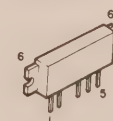
2SC1971



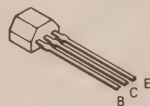
2SD1406



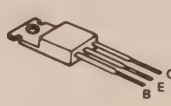
M57735



2SC2459



2SC2509

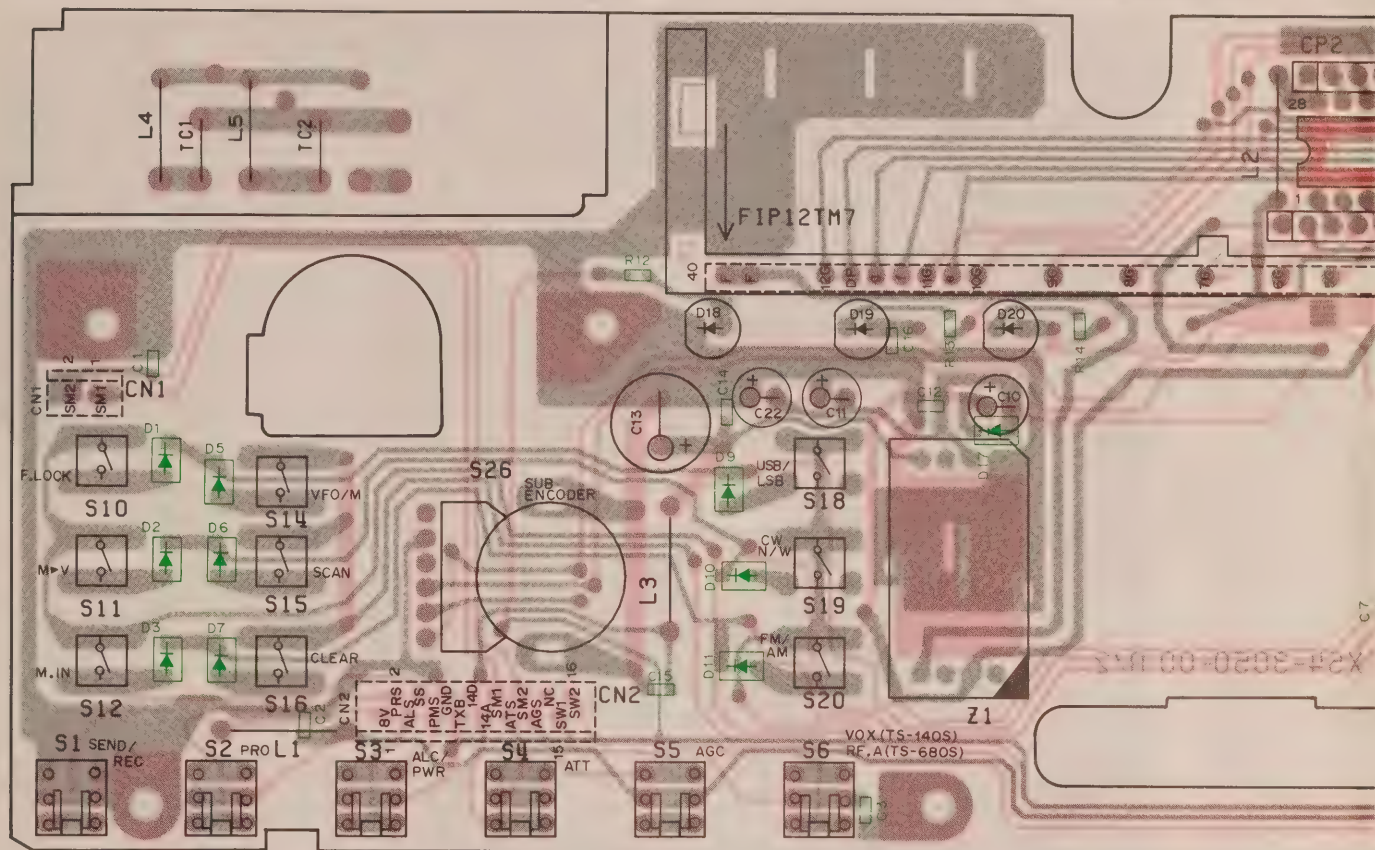


2SC2538-22-A

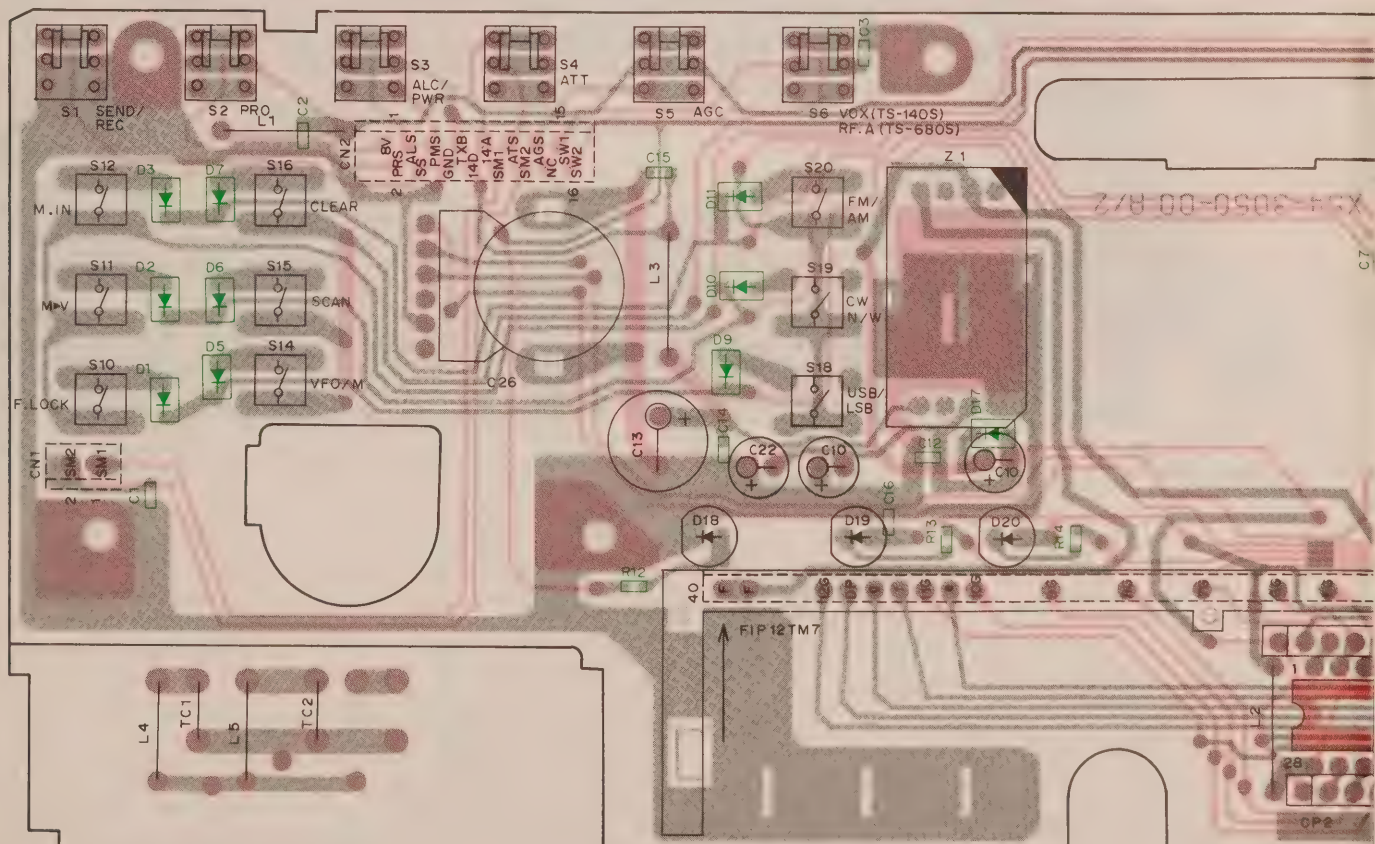


TS-140S/680S PC BOARD VIEWS

DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W) Component side view

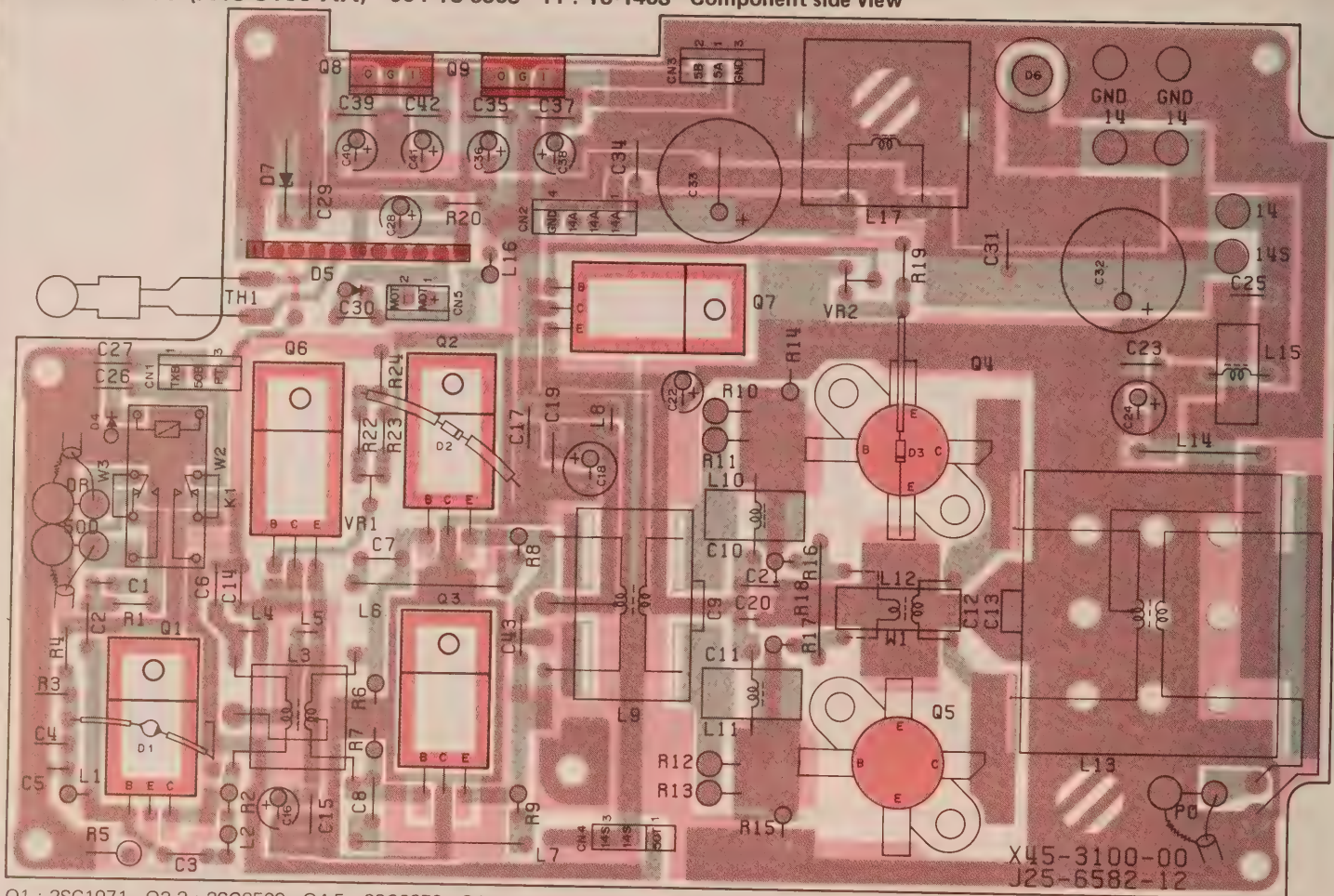


DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W) Foil side view



TS-140S/680S PC BOARD VIEWS

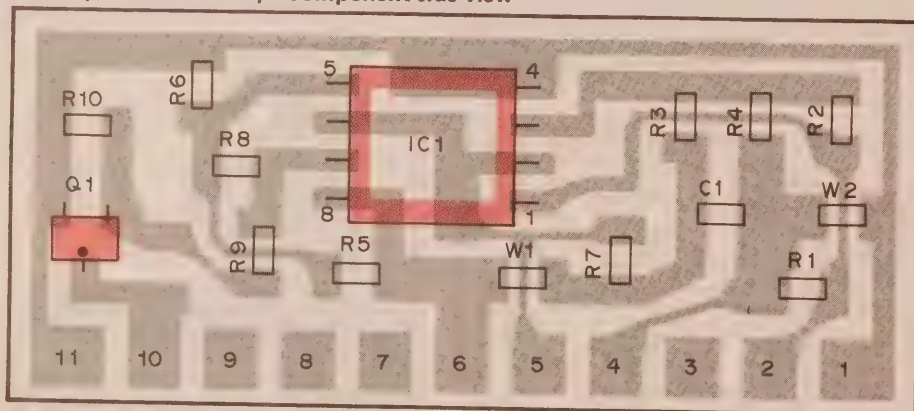
FINAL UNIT (X45-3100-XX) -00 : TS-680S -11 : TS-140S Component side view



Q1 : 2SC1971 Q2,3 : 2SC2509 Q4,5 : 2SC2879 Q6,7 : 2SD1406(Y) Q8,9 : AN7805
D1 : MV-5T D2,3 : SV-03YS D4,5 : 1S1555 D6 : SG-5LR D7 : MTZ8.2JA
TH1 : 5TP41L

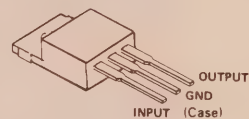
K1, D4, CN4, 50D : TS-680S only
W2, 3 : TS-140S only

FAN (X59-3370-00) Component side view



Q1 : 2SC2712(Y)
IC1 : NJM4558M

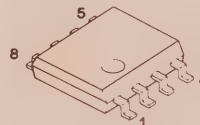
AN7805



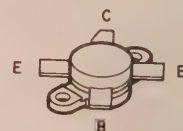
2SC2712(Y)



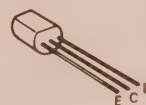
NJM4558M



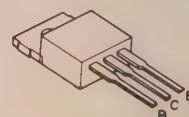
2SC2879



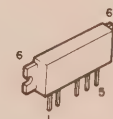
2SC1971



2SD1406



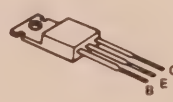
M57735



2SC2459



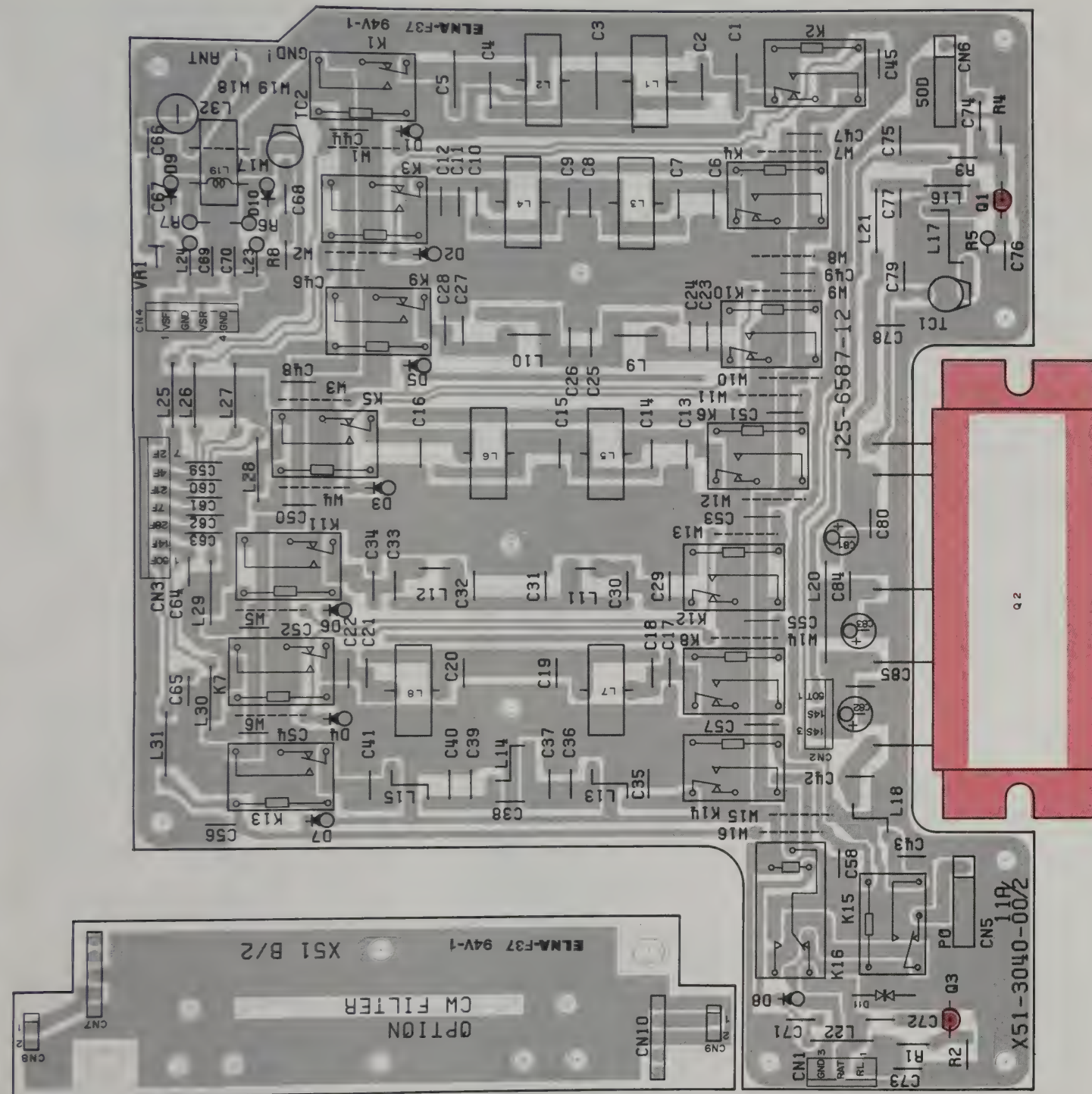
2SC2509



2SC2538-22-A



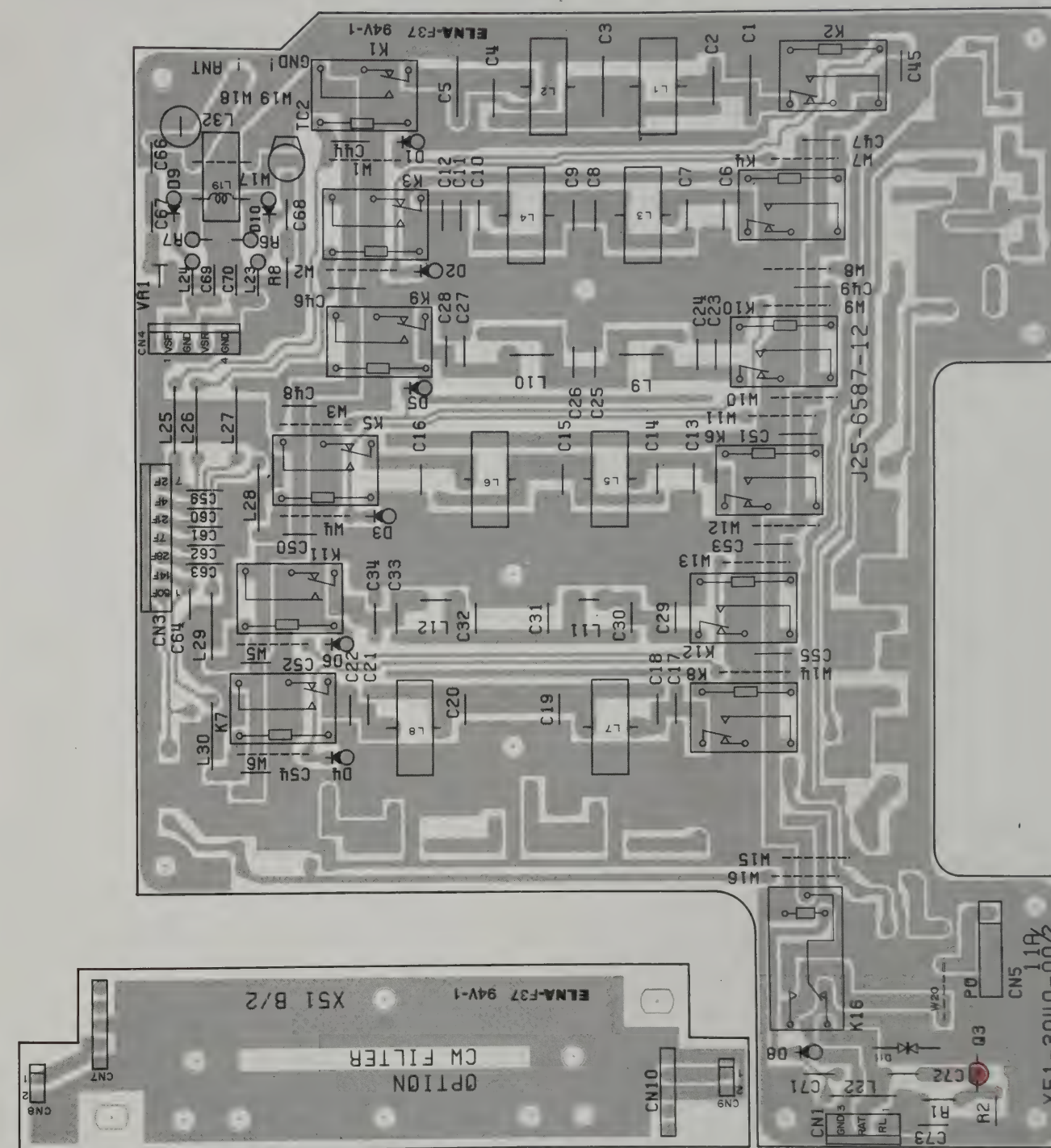
FILTER UNIT (X51-3040-00) : TS-680S Component side view



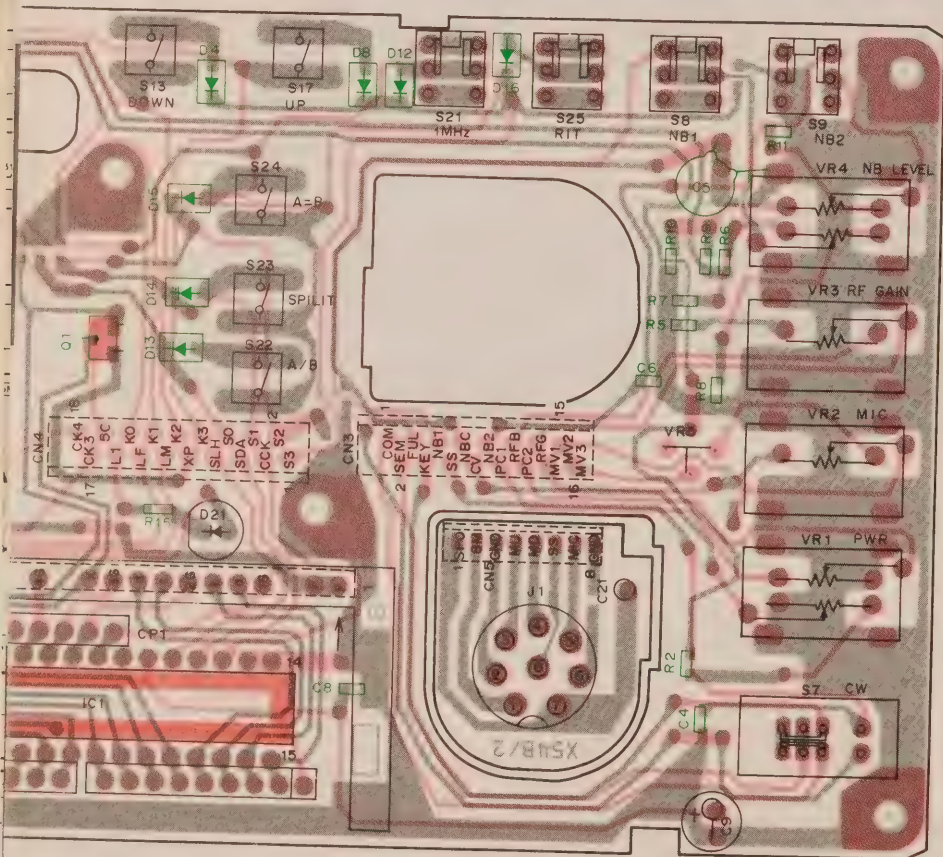
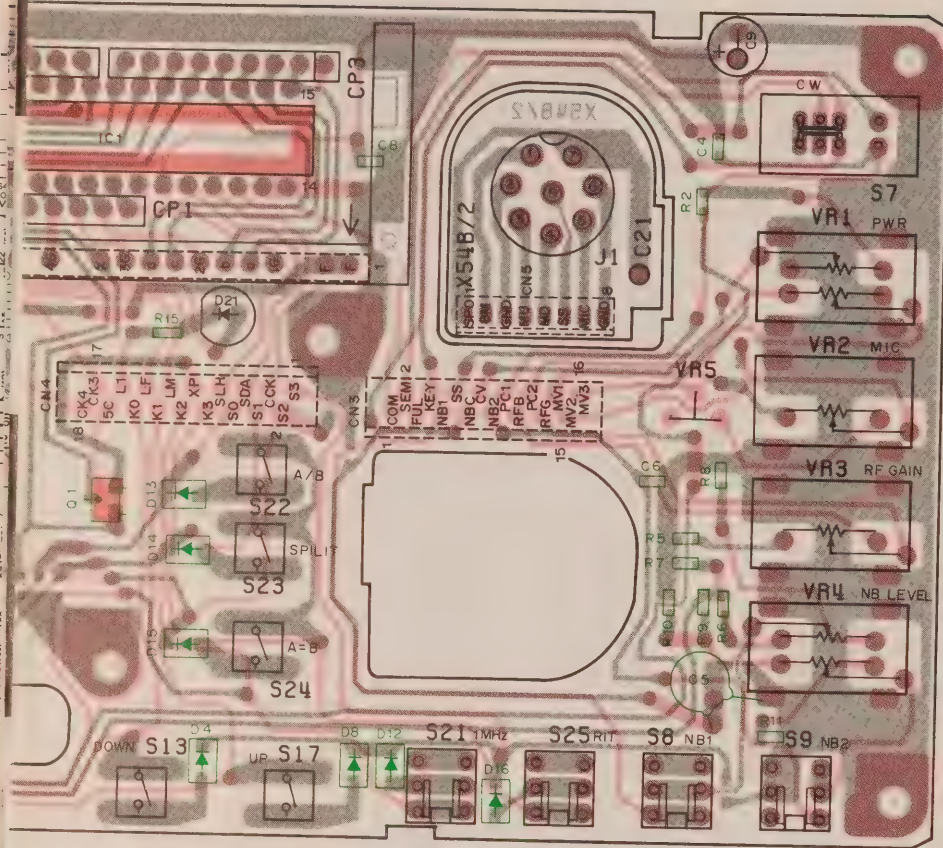
Q1 : 2SC2538-22-A Q2 : M57735 Q3 : 2SC2459(BL)
D1-8 : 1S1555 D9,10 : 1SS101 D11 : DSP301N

PC BOARD VIEWS TS-140S/680S

FILTER UNIT (X51-3040-11) : TS-140S Component side view



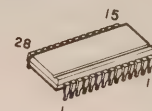
Q3 : 2SC2459(BL)
D1-6,8 : 1S1555 D9,10 : 1SS101 D11 : DSP301N



DTA114EK

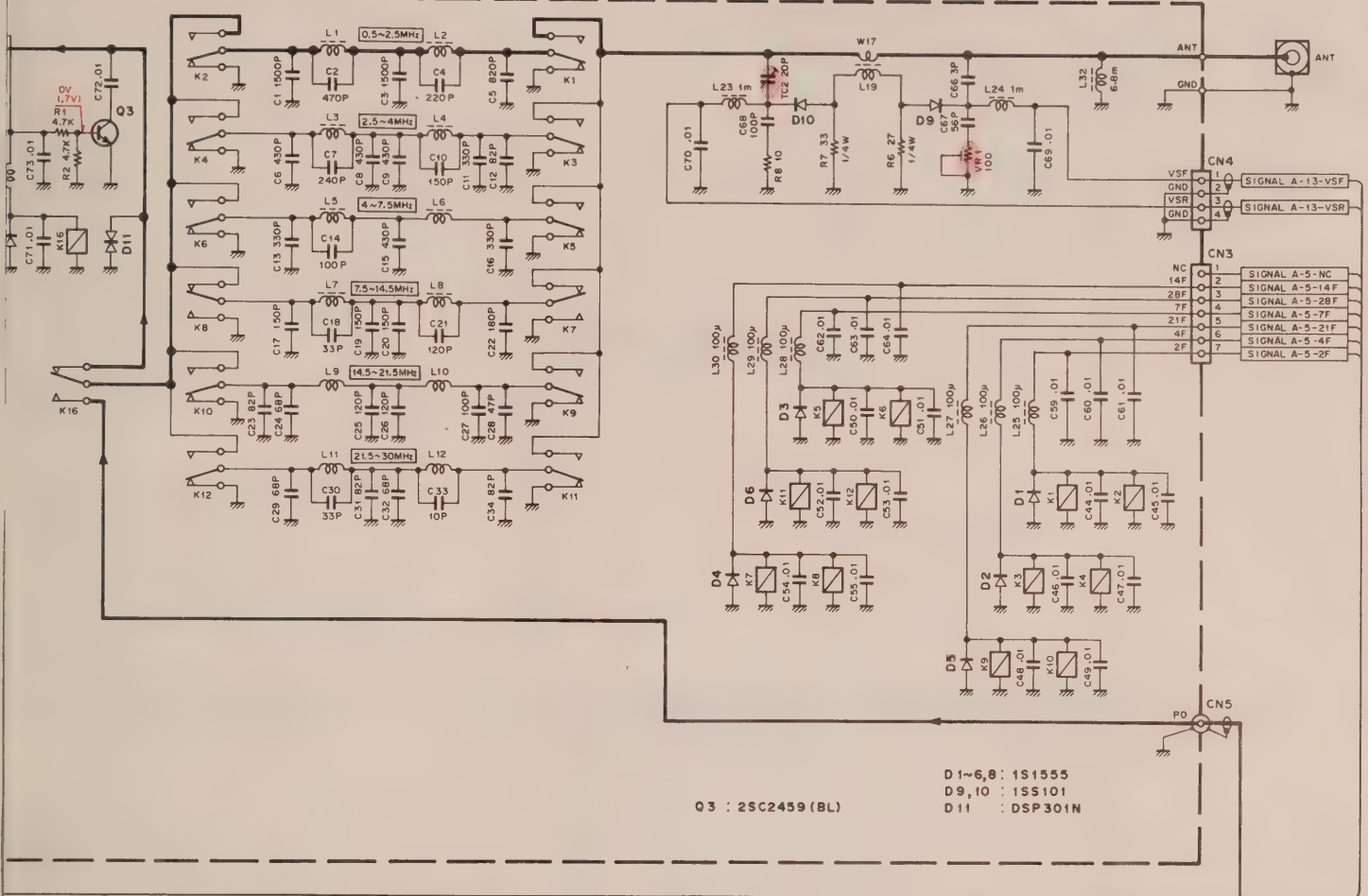


μPD6300C

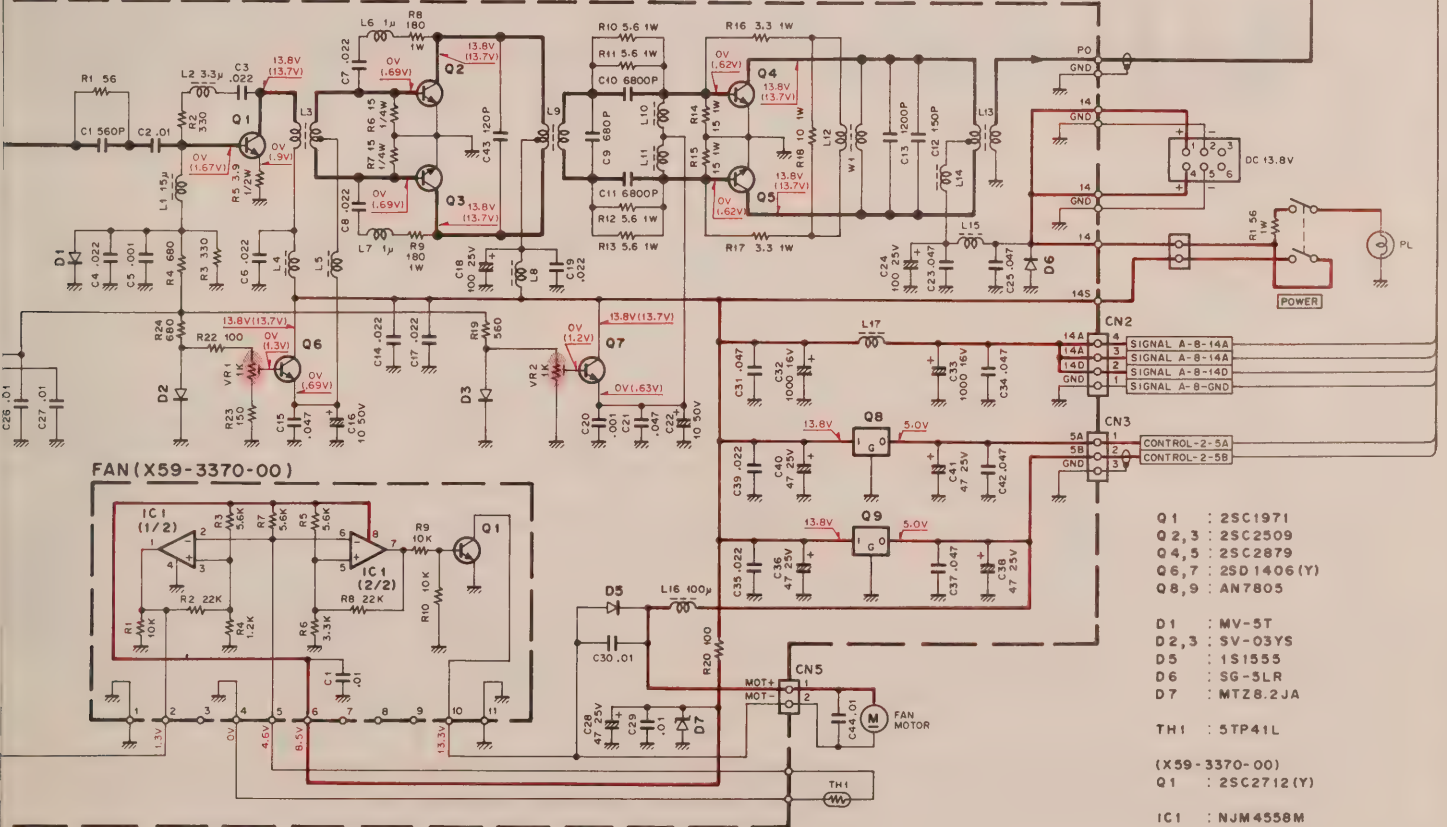


Voltage measurement condition $f = 14\text{MHz}$. SSB MIC GAIN MIN.
Mode : USB. () : TX.

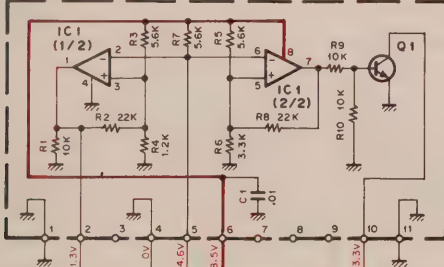
ER UNIT (X51-3040-11) (A/2)



FINAL UNIT (X45-3100-11)



FAN (X59-3370-00)



Q1 : 2SC1971
Q2,3 : 2SC2509
Q4,5 : 2SC2879
Q6,7 : 2SD1406 (Y)
Q8,9 : AN7805

D1 : MV-5T
D2,3 : SV-03YS
D5 : 1S1555
D6 : SG-5LR
D7 : MTZ8.2JA

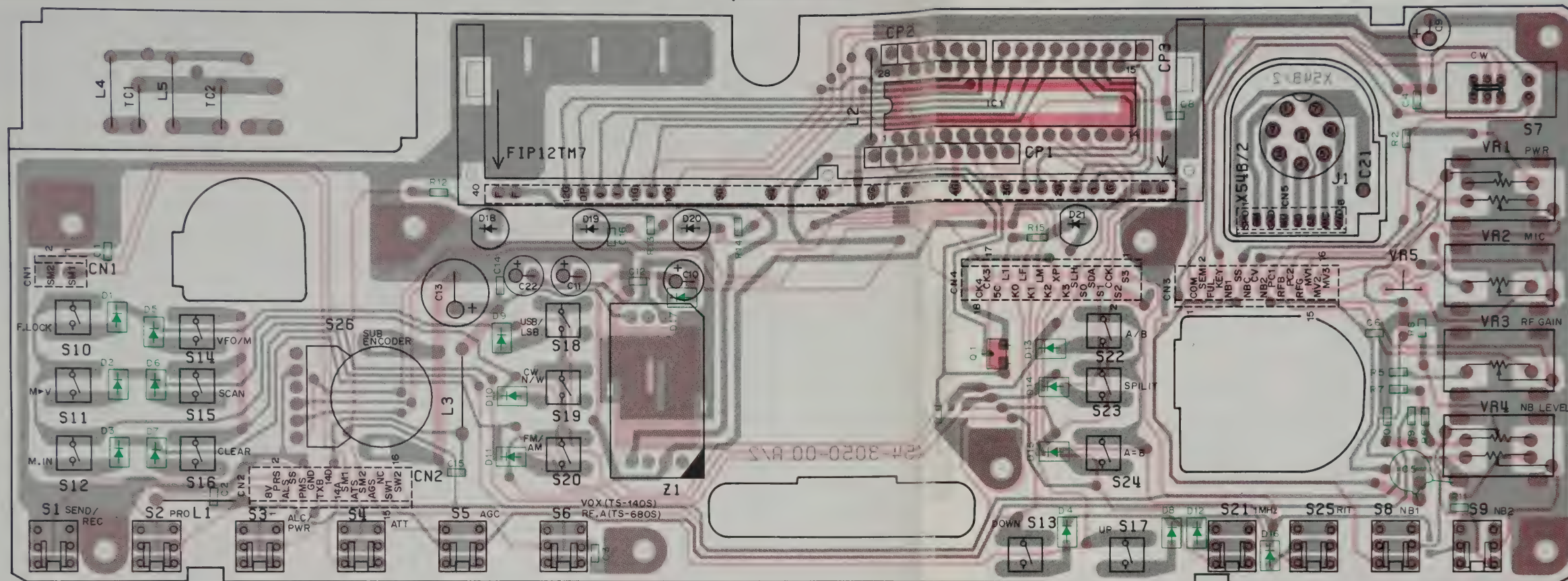
TH1 : 5TP41L

(X59-3370-00)
Q1 : 2SC2712 (Y)

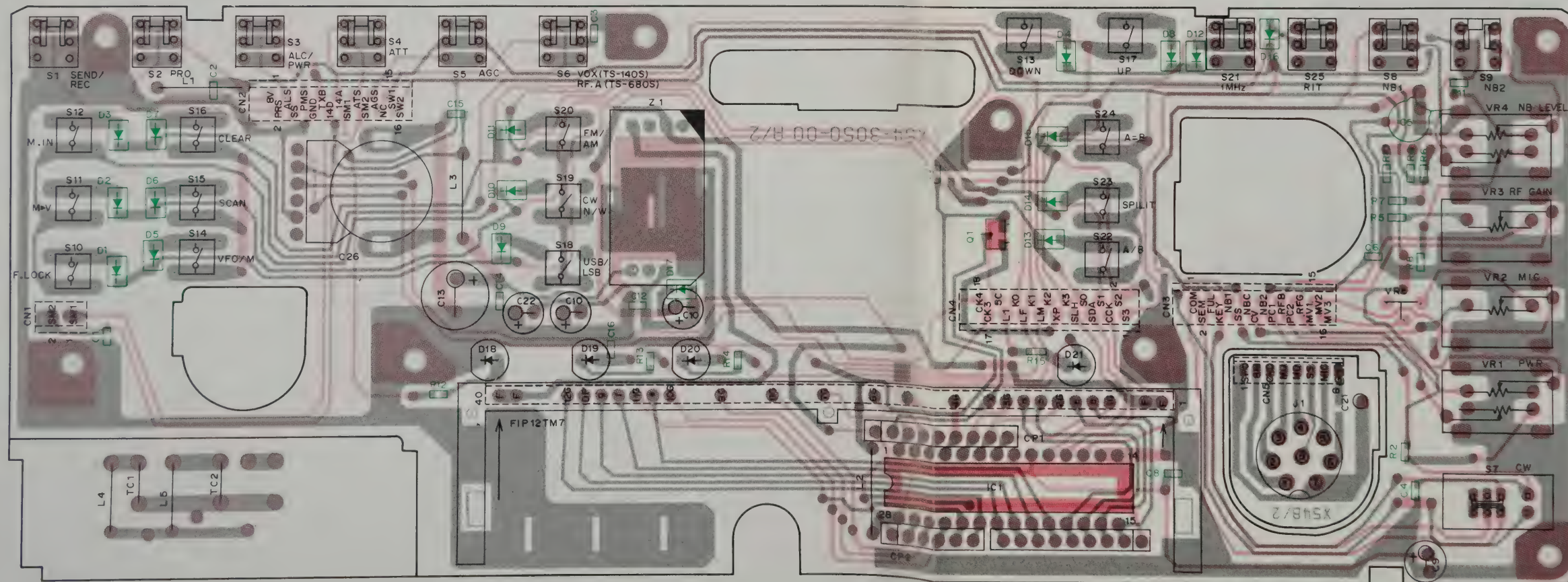
IC1 : NJM4558M

TS-140S/680S PC BOARD VIEWS

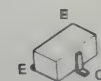
DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W) Component side view



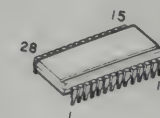
DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W) Foil side view



DTA114EK



μPD6300C

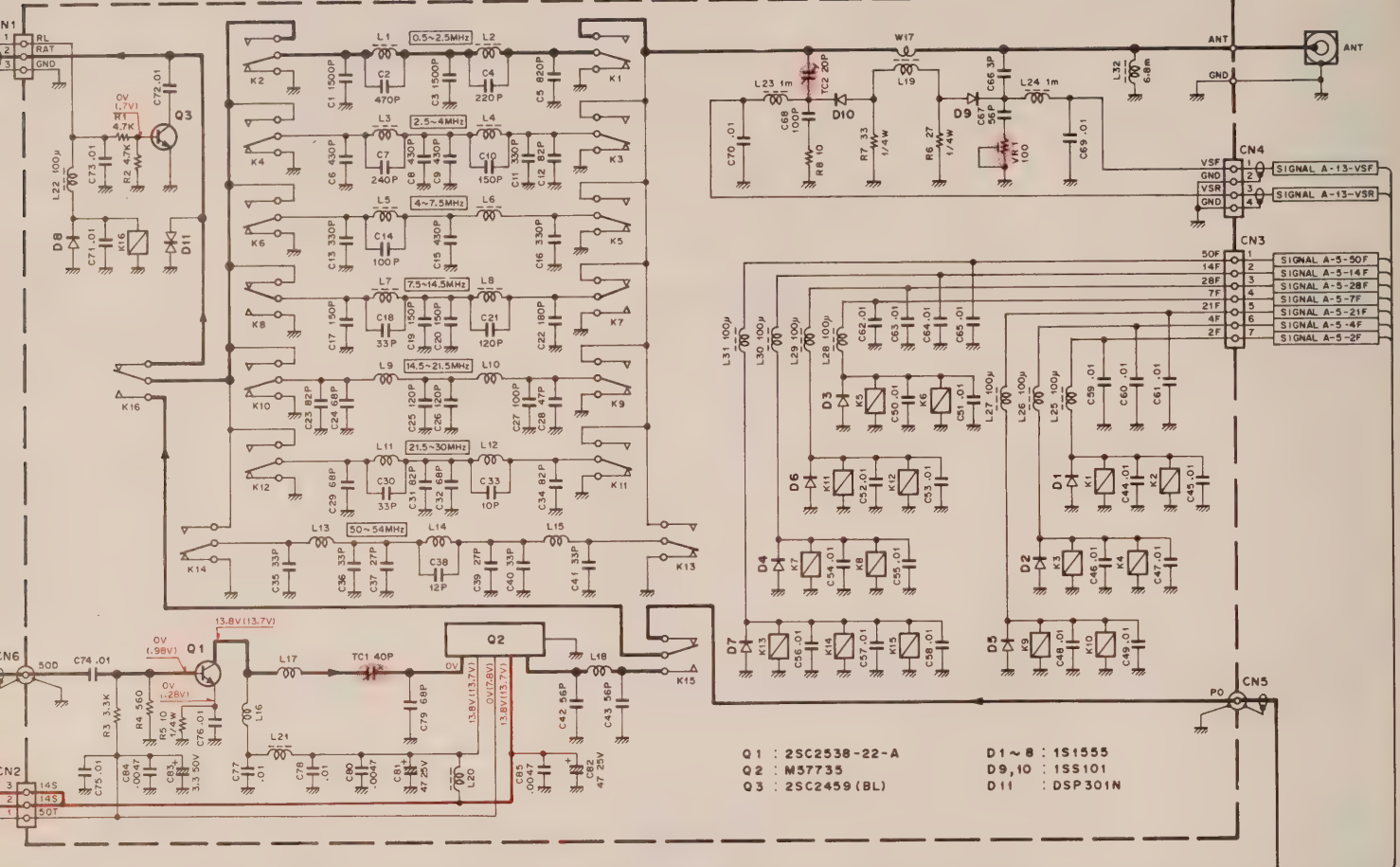


Mode : USB. () : TX.

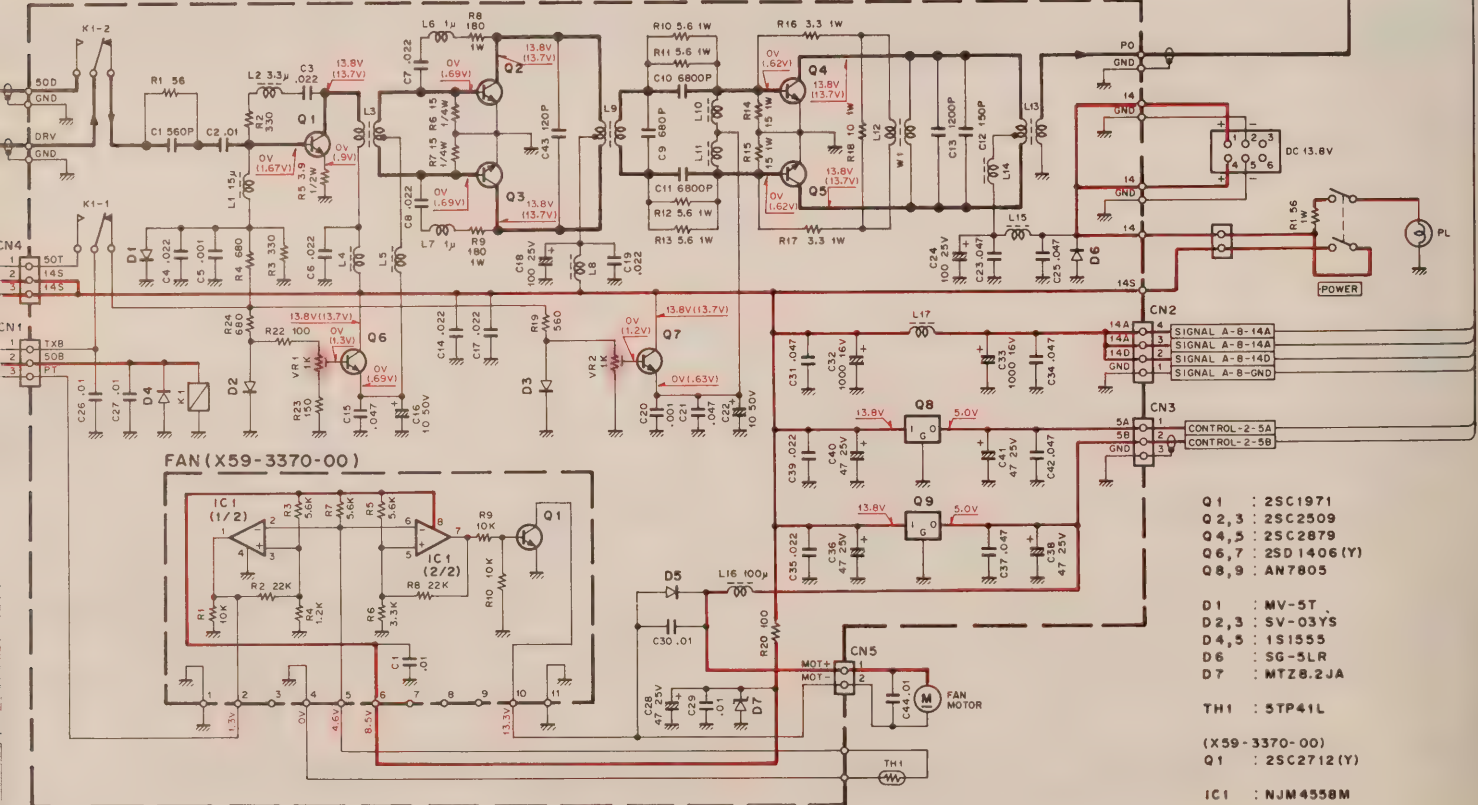


Voltage measurement condition FILTER UNIT : f=52MHz. FINAL UNIT : f=14MHz. SSB MIC GAIN.
SWITCH UNIT, DISPLAY UNIT : f=14MHz, Mode : USB. () : TX.

FILTER UNIT (X51-3040-00) (A/2)

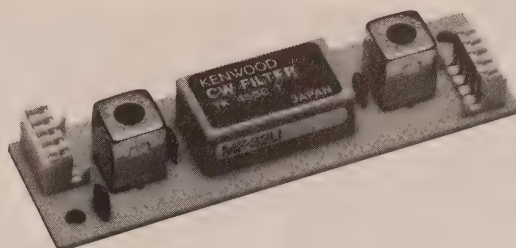


100W FINAL UNIT (X45-3100-00)



TK-455C-1 (CW FILTER)

YK-455C-1 EXTERNAL VIEW



YK-455C-1 ELECTRICAL CHARACTERISTICS

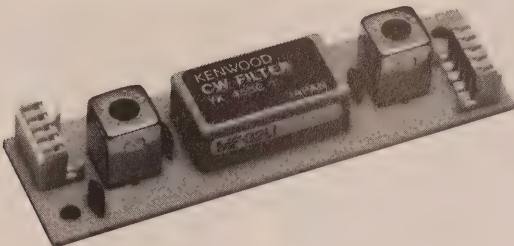
Item	Rating
Nominal center frequency (fo)	455kHz
Center frequency declination	Within $fo \pm 0.1\text{kHz}$ at 6dB
6dB pass bandwidth	$fo \pm 0.25\text{kHz}$ or more
60dB attenuation bandwidth	$fo \pm 1.1\text{kHz}$ or less
Ripple	3dB or less at within $fo \pm 0.2\text{kHz}$
Insertion loss	8dB or less
Spurious attenuation	70dB or more at within $fo \pm 60\text{kHz}$
I/O terminating impedance	$2\text{k}\Omega \pm 5\%$

————— Signal line - - - - - Control line ————— Common DC line



TK-455C-1 (CW FILTER)

YK-455C-1 EXTERNAL VIEW

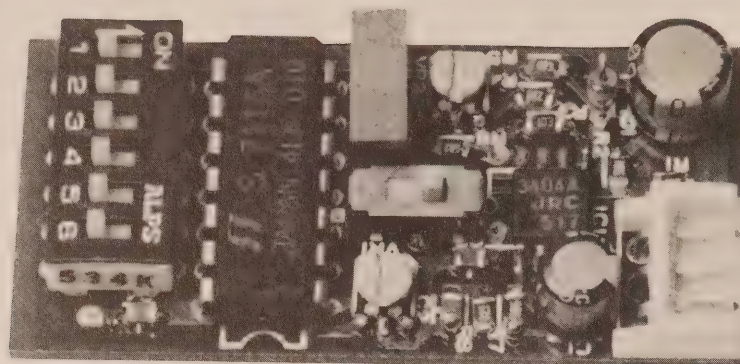


YK-455C-1 ELECTRICAL CHARACTERISTICS

Item	Rating
Nominal center frequency (fo)	455kHz
Center frequency declination	Within fo ± 0.1kHz at 6dB
6dB pass bandwidth	fo ± 0.25kHz or more
60dB attenuation bandwidth	fo ± 1.1kHz or less
Ripple	3dB or less at within fo ± 0.2kHz
Insertion loss	8dB or less
Spurious attenuation	70dB or more at within fo ± 60kHz
I/O terminating impedance	2kΩ ± 5%

TU-8 (TONE UNIT)

TU-8 EXTERNAL VIEW



TU-8 SPECIFICATIONS

Frequency range	38CH in 67.0–250.3Hz and 1750Hz, 1800Hz
Frequency Deviation	Within $\pm 0.5\%$
Max. Output Power	2.0Vrms $\pm 5\%$ at 1800Hz/1.5k Ω
Operating temperature	–20°C to +60°C
Power Supply Voltage	8V $\pm 5\%$
Semi-conductors	ICs : 2 Diode : 1
Weight	Approx. 10 grams
Dimensions	45 mm W
	22 mm D
	8 mm H (without cushion, etc.)

TU-8 (TONE UNIT)

TU-8 CIRCUIT DISCRIPTION

The TU-8 is a tone unit designed for the repeater operation of the TS-140S/680S.

● Outline

1. A six position DIP switch (Fig. 1) has been provided to allow selection of the desired tone frequency, 40 different frequencies are available (See Table 1.).
Use the DIP switch and Table 1 to select the desired tone frequency.

Freq. (Hz)	P1	P2	P3	P4	P5	P6	Freq. (Hz)	P1	P2	P3	P4	P5	P6
67.0	1	0	0	0	0	0	136.5	1	0	1	0	1	0
71.9	0	1	0	0	0	0	141.3	0	1	1	0	1	0
74.4	1	1	0	0	0	0	146.2	1	1	1	0	1	0
77.0	0	0	1	0	0	0	151.4	0	0	0	1	1	0
79.7	1	0	1	0	0	0	156.7	1	0	0	1	1	0
82.5	0	1	1	0	0	0	162.2	0	1	0	1	1	0
85.4	1	1	1	0	0	0	167.9	1	1	0	1	1	0
88.5	0	0	0	1	0	0	173.8	0	0	1	1	1	0
91.5	1	0	0	1	0	0	179.9	1	0	1	1	1	0
94.8	0	1	0	1	0	0	186.2	0	1	1	1	1	0
97.4	1	1	0	1	0	0	192.8	1	1	1	1	1	0
100.0	0	0	1	1	0	0	203.5	0	0	0	0	0	1
103.5	1	0	1	1	0	0	210.7	1	0	0	0	0	1
107.2	0	1	1	1	0	0	218.1	0	1	0	0	0	1
110.9	1	1	1	1	0	0	225.7	1	1	0	0	0	1
114.8	0	0	0	0	1	0	233.6	0	0	1	0	0	1
118.8	1	0	0	0	1	0	241.8	1	0	1	0	0	1
123.0	0	1	0	0	1	0	250.3	0	1	1	0	0	1
127.3	1	1	0	0	1	0	1750.0	1	1	1	1	0	1
131.8	0	0	1	0	1	0	1800.0	0	0	0	0	1	1

(1 : ON 0 : OFF)

Table 1 Program

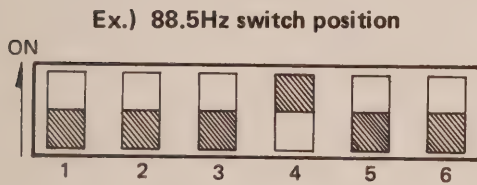


Fig. 1 DIP Switch

TU-8 ADJUSTMENT

● Deviation adjustment

The TU-8 has been present at factory for $\pm 600\text{Hz}$. The deviation is adjusted by with VR1 to Max. $\pm 2\text{kHz}$ with the deviation potentiometer full clockwise when the TU-8 is installed on the TS-140S/680S.

2. Tone-burst or continuous tone selection :
A switch is provided to allow selection of either the tone-burst or continuous tone mode.
The burst duration can be adjusted by with VR2.

*1 Tone-burst mode :

A tone will be generated for a brief period at the beginning of each transmission.

*2 Continuous-tone mode :

A tone will be generated as long as the PTT switch is depressed. Since the tone is adjusted for a sub-audible level, this should not interfere with normal communications.

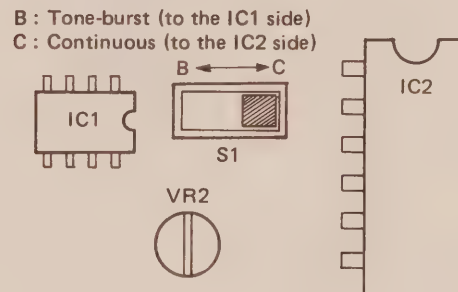


Fig. 2 Tone-burst or continuous-tone selection switch

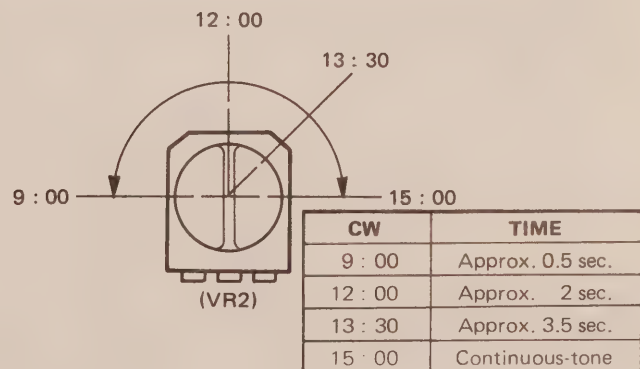


Table 2

Fig. 3 Burst time adjustment

TU-8 (TONE UNIT)

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

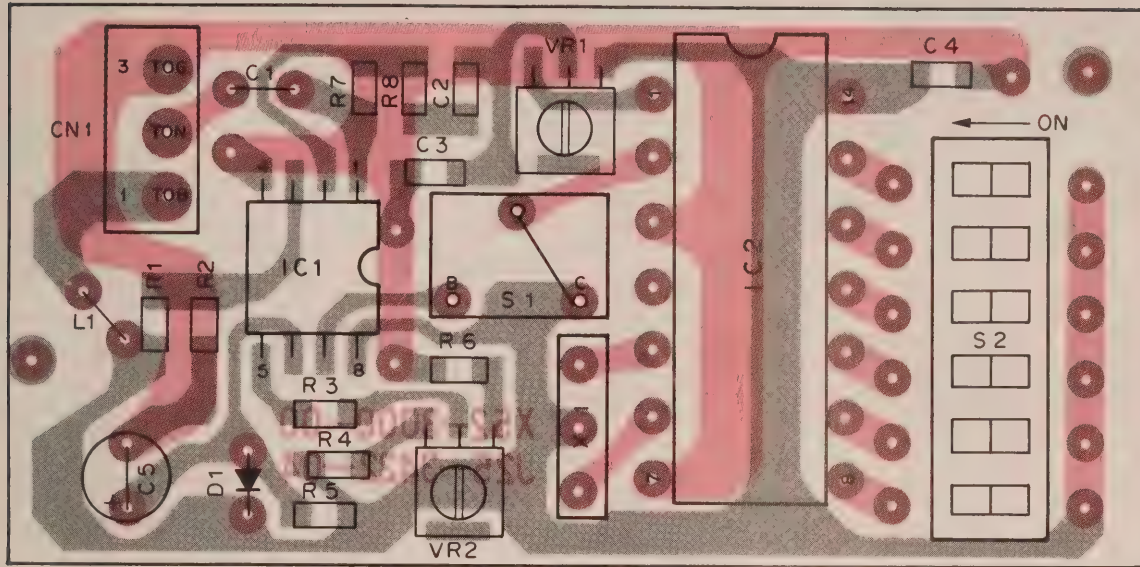
TU-8 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
TU-8						
-		*	X52-3000-00	TONE UNIT		
TONE UNIT (X52-3000-00)						
C1			CE04CW1A220M	ELECTR0	22UF	10WV
C2 -4			CK73FB1E103K	CHIP C	0.010UF	K
C5			CE04CW1A470M	ELECTR0	47UF	10WV
C6			CC45SL1H102J	CERAMIC	1000PF	J
L1			L40-2211-17	SMALL FIXED INDUCTOR		
X1			L78-0018-05	CERAMIC OSCILLATOR (3.58MHZ)		
R1 ,2			RK73FB2A105J	CHIP R	1.0M	J 1/10W
R3			RK73FB2A103J	CHIP R	10K	J 1/10W
R4			RK73FB2A222J	CHIP R	2.2K	J 1/10W
R5			RK73FB2A473J	CHIP R	47K	J 1/10W
R6			RK73FB2A682J	CHIP R	6.8K	J 1/10W
R7			RK73FB2A105J	CHIP R	1.0M	J 1/10W
R8			RK73FB2A823J	CHIP R	82K	J 1/10W
VR1 ,2		*	R12-4418-05	TRIMMING P0T (50K)		
S1			S31-1411-05	SLIDE SWITCH (3P)		
S2		*	S59-6401-05	DIP SWITCH (SSGM16 6P)		
D1			1SS133	DIODE		
IC1		*	NJM3404AM	IC(OP AMP X2)		
IC2			S7116A	IC(TONE ENCODER)		

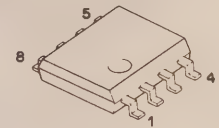
TU-8 (TONE UNIT)

TU-8 PC BOARD VIEW

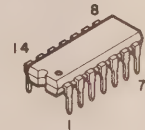
TONE UNIT (X52-3000-00) Component side view



NJM3404AM

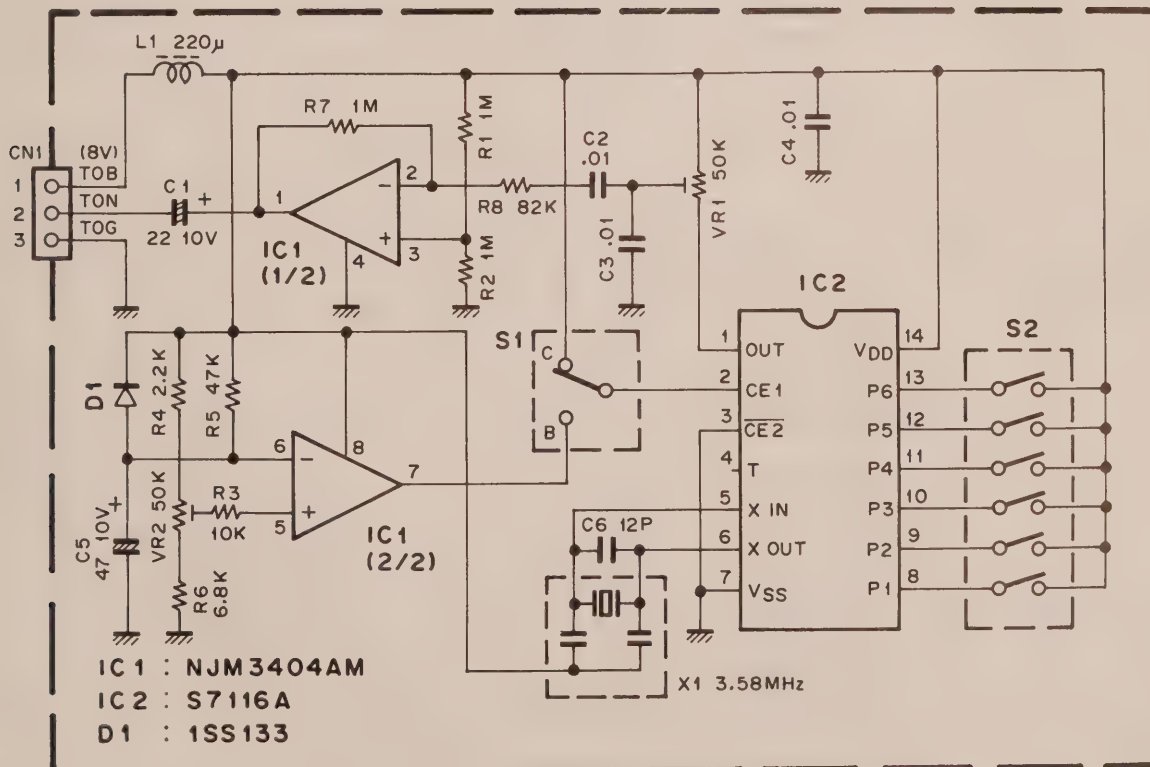


S7116A



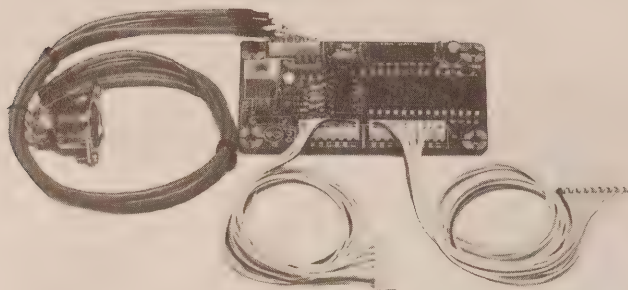
TU-8 SCHEMATIC DIAGRAM

TONE UNIT (X52-3000-00)



IF-10C (INTERFACE KIT)

IF-10C EXTERNAL VIEW



IF-10C SPECIFICATIONS

Power requirement	DC 5.0V (4.5 ~ 5.5V)
Current drain	100mA
Interface signal level	
Output signal	"L" level 0 ~ 0.4V
	"H" level 2.4 ~ 5V
Input signal	"L" level 0 ~ 0.8V
	"H" level 2 ~ 5V
Operating temperature	-10°C ~ +50°C

IF-10C PARTS LIST

* : New Parts

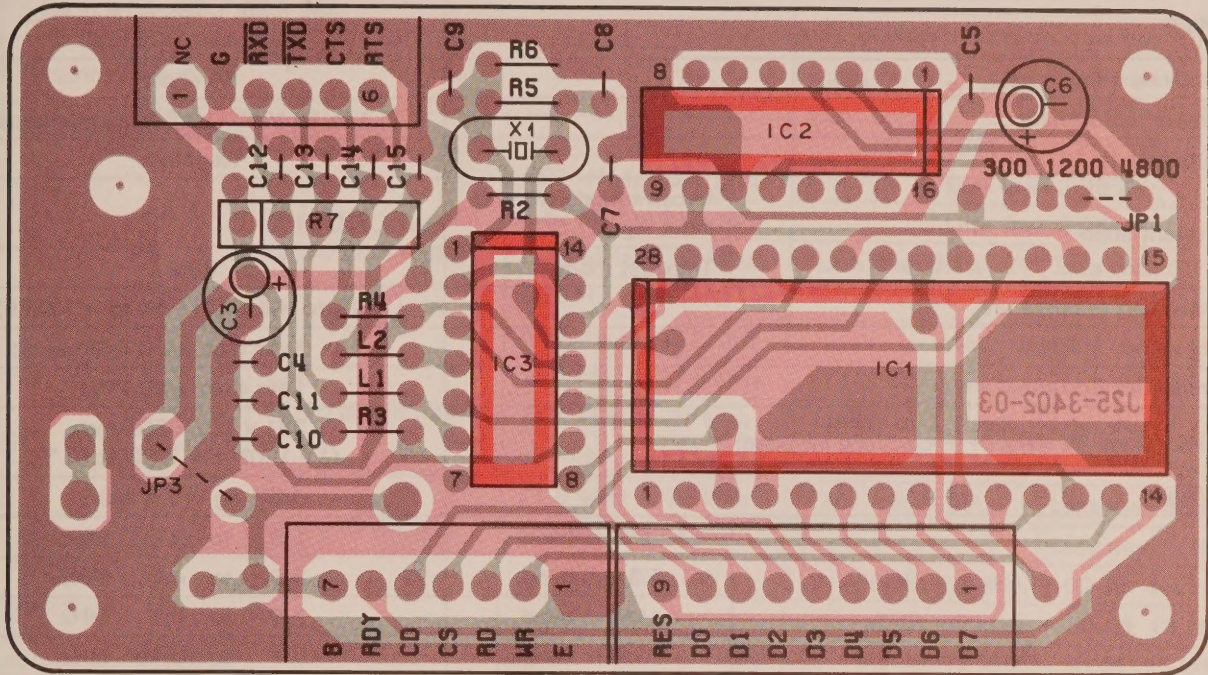
Parts without Parts No. are not supplied.

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
IF-10C						
		*	B42-3317-04 B42-3319-04	Serial plate Plate	K	
			CK45F1H103Z	C 0.01μF Z (DIN)		
		*	E06-0655-05	6P DIN Connector		
		*	E31-3331-05	Connector with lead (DIN)		
		*	E31-3333-05	Connector with lead 7P		
		*	E31-3334-05	Connector with lead 9P		
		*	H13-0804-04	Protection plate		
		*	H25-0711-04	Antistatic bag		
		*	H25-0712-04	Antistatic bag (PC board)		
			J61-0307-05	Wire band		
			N30-2605-41	Pan head screw M2.6 x 5 (DIN)		
			N87-2606-46	Brazier head taptite screw φ2.6 x 6		
		*	X57-1160-02	Interface unit		
INTERFACE UNIT (X57-1160-02)						
C3			CE04CW0J470M	Electro 47μF 6.3WV		
C4, 5			C91-0117-05	C 0.01μF		
C6			CE04CW0J470M	Electro 47μF 6.3WV		
C7			C91-0117-05	C 0.01μF		
C8, 9			CK45B1H102K	C 1000pF K		
C10 - 15			C91-0117-05	C 0.01μF		
L1, 2			L40-1011-16	Ferri-inductor 100μH		
X1		*	L78-0015-05	Ceramic resonator CSA2.45MG11		
R2			RD14BB2C103J	RD 10K J		
R3, 4			RD14BB2C101J	RD 100 J		
R5			RD14BB2C222J	RD 2.2K J		
R6			RD14BB2C472J	RD 4.7K J		
R7		*	R90-0597-05	Resistor block 1K x 4		
JP1, 3			R92-1061-05	Jumper wire		
IC1		*	μPD8251AFC	IC		
IC2		*	TC4040BP	IC		
IC3		*	HD7404P	IC		

IF-10C (INTERFACE KIT)

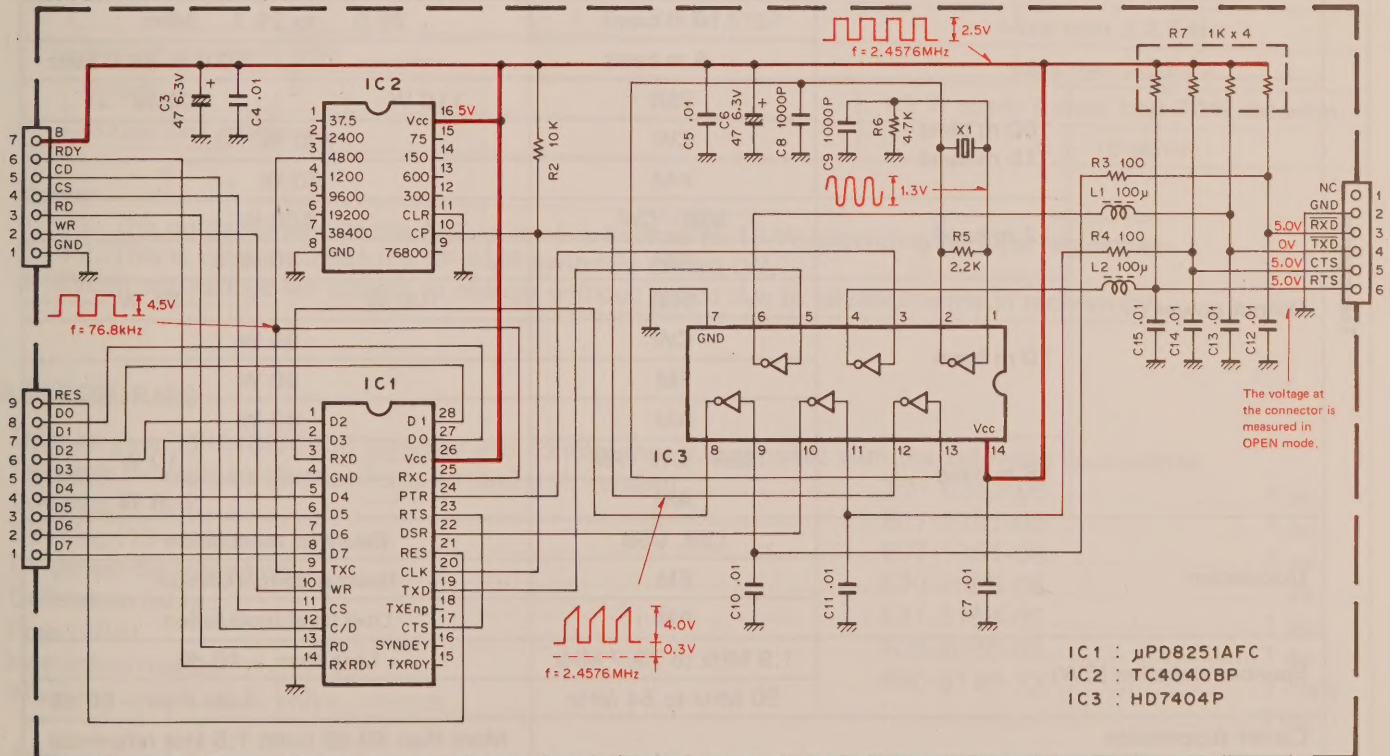
IF-10C PC BOARD VIEW

INTERFACE UNIT (X57-1160-02)



IF-10C SCHEMATIC DIAGRAM

INTERFACE UNIT (X57-1160-02)



SPECIFICATIONS

Specifications			Model	TS-140S	TS-680S
General	Mode		J3E (LSB, USB), A1A (CW), A3E (AM), F3E (FM)		
	Antenna impedance		50 ohms		
	Power requirement		12 to 16 VDC (13.8 VDC reference)		
	Grounding		Negative		
	Current drain	Receive mode with no input signal		1.5 A	
		Transmit mode		20 A	
	Operating temperature		- 10 to +50°C (+ 14 to + 122°F)		
	Frequency stability		Less than ± 10 PPM		
	Frequency accuracy		Less than ± 10 PPM		
	Dimensions (W × H × D) (Projections included)		281 × 107 × 305 mm (11-1/16" × 4-7/32" × 12")		
Weight		6.1 kg (13.4 lbs)			
Transmitter	Frequency range		160 m band	1.8 to 2.0 MHz	
			80 m band	3.5 to 4.0 MHz	
			40 m band	7.0 to 7.3 MHz	
			30 m band	10.1 to 10.15 MHz	
			20 m band	14.0 to 14.35 MHz	
			17 m band	18.068 to 18.168 MHz	
			15 m band	21.0 to 21.45 MHz	
			12 m band	24.89 to 24.99 MHz	
			10 m band	28.0 to 29.7 MHz	
			6 m band	————	50.0 to 54.0 MHz
	Output power	160 m band ~ 15 m band	SSB	110 W *1	100 W *1
			CW	100 W *1	
			AM	40 W *1	
		12 m band	SSB · CW	100 W	
			AM	40 W	
		10 m band	SSB	100 W	95 W
			CW	95 W	
			FM	50 W	
			AM	40 W	
		6 m band	SSB · CW · FM	————	10 W
	AM		————	4 W	
	Modulation		LSB, USB	Balanced modulation	
			FM	Reactance modulation	
			AM	Low level modulation	
	Spurious radiation (CW)		1.9 MHz to 29.7 MHz	Less than - 40 dB	
			50 MHz to 54 MHz	————	Less than - 60 dB
	Carrier suppression			More than 40 dB (with 1.5 kHz reference)	
	Unwanted sideband suppression			More than 50 dB (with 1.5 kHz reference)	
Maximum frequency deviation (FM)			± 5 kHz		
Frequency response (- 6 dB)			400 to 2600 Hz		
Microphone impedance			500 ohms to 50 kΩ		

SPECIFICATIONS

Specifications			Model	TS-140S	TS-680S
Receiver	Circuitry			Double conversion superheterodyne	
	Frequency range			500 kHz to 30 MHz	500 kHz to 30 MHz 50 MHz to 54 MHz
	Intermediate frequency			1st: 40.055 MHz, 2nd: 455 kHz	
	Sensitivity	LSB, USB, CW (at 10 dB S+N/N)	500 kHz to 1.62 MHz	Less than 3.98 μ V	
			1.62 MHz to 21.5 MHz	Less than 0.25 μ V	
			21.5 MHz to 30 MHz	Less than 0.25 μ V	Less than 0.18 μ V *2
			50 MHz to 54 MHz	—	Less than 0.16 μ V *2
		AM (at 10 dB S+N/N)	500 kHz to 1.62 MHz	Less than 39.8 μ V	
			1.62 MHz to 21.5 MHz	Less than 2.5 μ V	
			21.5 MHz to 30 MHz	Less than 2.5 μ V	Less than 1.78 μ V *2
			50 MHz to 54 MHz	—	Less than 1.58 μ V *2
		FM (at 12 dB SINAD)	21.5 MHz to 30 MHz	Less than 0.35 μ V	Less than 0.18 μ V *2
			50 MHz to 54 MHz	—	Less than 0.18 μ V *2
	Selectivity	LSB, USB, CW		-6 dB: 2.2 kHz, -60 dB: 4.4 kHz	
		AM		-6 dB: 6 kHz, -50 dB: 18 kHz	
		FM		-6 dB: 12 kHz, -50 dB: 25 kHz	
	Image ratio			More than 50 dB	
	1st IF rejection			More than 50 dB	
	IF SHIFT variable range			More than ± 1.2 kHz	
	RIT variable range	10 Hz STEP		More than ± 1.2 kHz	
		20 Hz STEP		More than ± 2.5 kHz	
	Squelch sensitivity (FM)			Less than 0.32 μ V	
	Output			1.5 W across 8 ohms load (10% distortion)	
	Output load impedance			8 ~ 16 ohms	

Notes:

- *1: The output power on the 160 m band is limited to 10 W depending on local regulations.
- *2: This is valuable when the RF AMP switch is turned ON.
- Circuit and ratings are subject to change without notice due to advancements in technology.

ACCESSORIES

Unpack your TS-140S/680S carefully and confirm that it is supplied with the following accessories.

Dynamic microphone (Except European and U.K. version)	T91-0352-05	1 ea.
DIN plug (7-pin)	E07-0751-05	1 ea.
DIN plug (13-pin)	E07-1351-05	1 ea.
DC power cable assembly	E30-2065-05	1 ea.
Calibration cable	E31-2154-05	1 ea.
Fuse (20A)	F05-2036-05	1 ea.
Instruction manual	B50-8199-XX	1 copy
Warranty card (U.S.A. only)		1 ea.

After unpacking

Shipping container:

Save the boxes and packing in the event your unit needs to be transported for remote operation, maintenance, or service.

TS-140S/680S

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